The Glass Industry
REG. U. S. PAT. OFF.

Vol. 10 FEBRUARY, 1929 No. 2

Die-Casting Glass

Practical Suggestions on the Use of Font Molds

By Roy E. Swain[1]

DIE-CASTING in the metal industry consists of flowing molten metal under pressure into molds. This is usually accomplished by means of a cylinder and piston submerged in the melting pot and connected with the mold by means of a spout.

The high melting point of glass, the special materials needed for melting pots and the physical properties of glass make necessary the redesigning of metal die-casting equipment to work successfully with glass. However, this change in design does not alter the principle or method involved. At different times equipments have been designed to cast glass directly from the melting unit but it is doubtful if any of these have been used with success.

The metals used for die-casting flow freely while glass is viscous and flows sluggishly into the mold, besides being difficult to separate into smaller units. The die-casting of glass is much more wasteful of material than that of metal as not only is the sprue returned as scrap but the well or font is also returned. Very few articles are made by this method that can be produced successfully by straight pressing. The greater part of the products of the font molds may be classed as solid or heavy glassware such as door knobs, strain insulators, etc. Nearly all this ware requires finishing by grinding, and in many cases polishing, to remove the roughness at the point where the sprue is removed.

There are several well defined types of font molds each developed for the manufacture of a peculiar type of article. Besides these, many ingenious molds have been devised expressly for unusual shapes that bring about conditions that are not provided for in the more or less standardized molds. The font and plunger, common to all these molds, will be given first consideration and a number of them described to point out their advantages and disadvantages.

Figure 1a illustrates a cylinder and piston often shown in layout drawings of such molds. This combination is impracticable as the glass coming in contact with the wall of the font acquires enough set to form a shell of chilled glass that will resist the pressure of the plunger. It may be pointed out here that in hot mold work the surface glass that comes in contact with the mold will remain stationary in relation to the mold except in rare instances. There may be

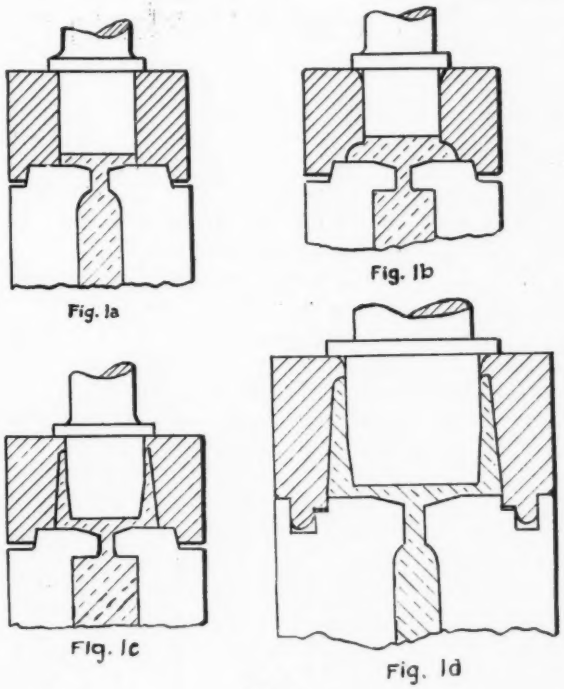


FIG. 1

instances where a frictional contact between the mold and glass is unavoidable but more often a study of the mold will show a way to eliminate this condition. In Figure 1b is an instance of surface glass moving in relation to the mold. The cylinder or well is here undercut permitting the piston to force the chilled ring of glass back into the body of molten glass. The friction and cutting action of the glass make the care and upkeep of these molds rather expensive. Such wells are being used to produce ware but they are not the best nor cheapest.

Figure 1c illustrates a lift-off font that is easily made, stands abuse and requires but little care and upkeep. By

[1] Engineering Department, Macbeth-Evans Glass Company.

standardizing the font seat on the molds a single font and plunger may be made to serve any number of molds. This font is wasteful of glass but the ease of operation, high production and low cost of equipment will usually outweigh this fault.

In making articles requiring a considerable amount of glass there is often a tendency for the glass to get between the font and the mold, causing a fin and often releasing the pressure to such an extent that the mold will not fill. To prevent this the font may be locked to the mold by means of

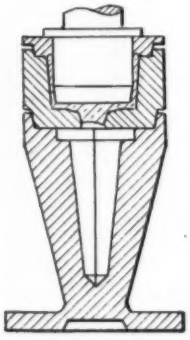


FIG. 2

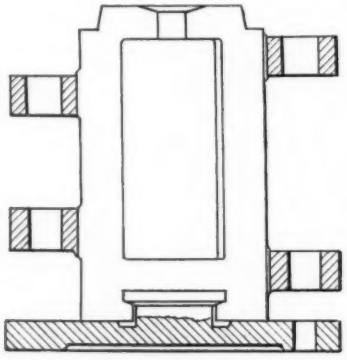


FIG. 3

a bayonet lock. This lock requires too much of the presser's time especially where it is necessary to unlock the mold quickly to permit the surface of the article to reheat. By floating the spring cage on the plunger-shaft some additional weight may be secured to provide additional resistance to this tendency that the font has of lifting. In Figure 1d is shown a method of seating the font that reduces the possibility of glass coming between the font and mold.

In turn-table or machine operation the transfer of the font from mold to mold would be impracticable, so molds for this type of equipment are provided with sectional fonts that are attached to or built into the mold. To fit a plunger to a set of sectional rings is a difficult task and only the most optimistic could hope to maintain this fit in service for more than a few hours. To eliminate this difficulty, a separate solid type ring may be provided that is easy to fit to the plunger and inexpensive to replace. This ring is attached to the spring plate and serves the entire set of molds. As the font ring and plunger form no part of the article it is well to provide means of causing them to work comparatively cold. By working these parts cold they are easily freed from the glass and are seldom damaged or need cleaning. Other points of font design will be brought out in the discussions of the mold designs.

A few articles that have sufficient taper to release them from the mold may be made in block molds using a shell type well having a gate that registers with the mold cavity as shown in Figure Two. This article is removed from the mold by means of the shell and when set sufficiently may be removed by rapping with a piece of hardwood. Where the production requirements warrant, the mold may be provided with a number of cavities and two or more shells.

For articles having parallel sides or undercuts sectional molds are required. In Figure Three a mold is shown for producing sight glasses to be used where excessive temperature or pressure would make the use of ordinary sheet or plate glass impracticable.

Font molds are very popular for making articles having eyes, such as radio insulators. A cross-section through a mold of this type is shown in Figure Four. The glass flowing around the pins will show a short lap which in most cases will not be objectionable. As in straight press-ware the point that fills last is subject to more wear than the rest of the mold. A joint at this point will soon give way unless extra precautions are taken in machining and fitting. This may be explained by pointing out that the hot glass here receives the full pressure of the plunger before a skin of chilled glass has formed sufficiently to bridge over the joint of the mold. This more fluid glass may enter a smaller

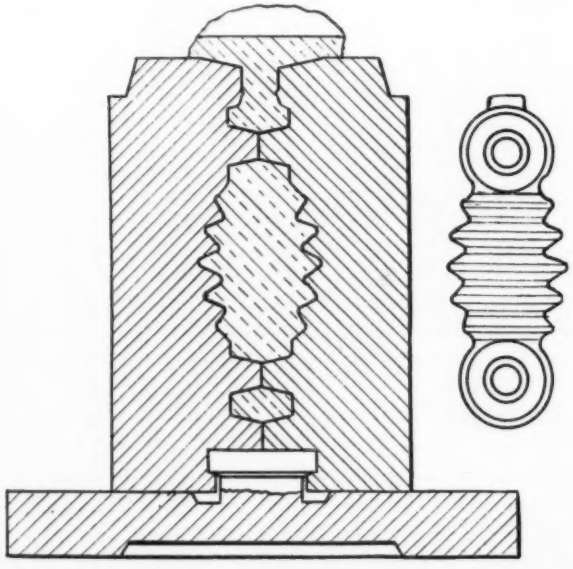


FIG. 4

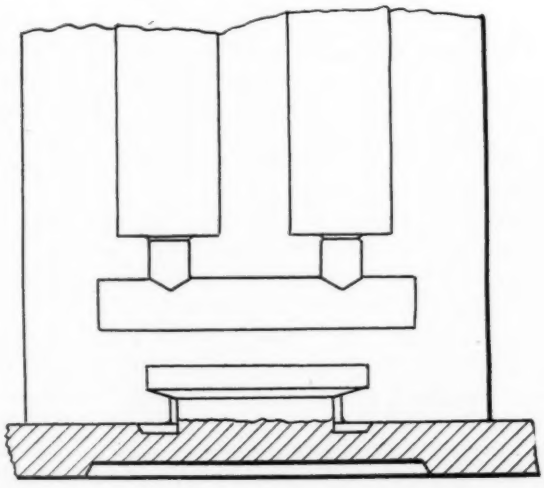


FIG. 5

joint and very quickly destroy the sharp edge of the mold.

Excessive pressure after the mold fills may strain the article, causing crizzles. These are especially annoying in multiple molds where there is trouble getting the molds to fill simultaneously. One ingenious method has been worked out to lessen the probability of these fins and crizzles. This is accomplished by providing an overflow into a common

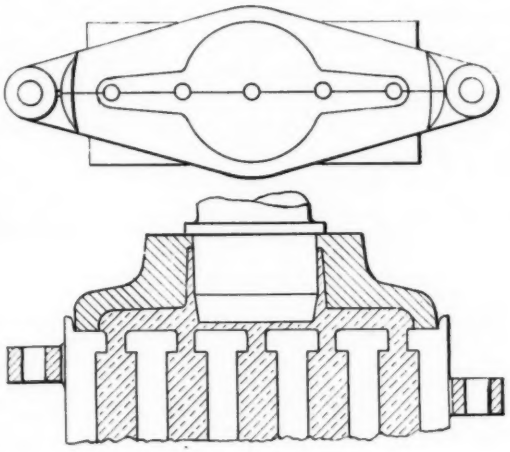


FIG. 6

chamber as shown in Figure Five. In this mold there is but one "fill" and the last place to fill is outside the mold proper. To increase production quite a number of cavities may be cut in a sectional mold but it is difficult to produce an oblong cup and hard to get glass into one when working. Oblong fonts are also wasteful of glass, hard to line up on the press and easily damaged as compared with round cups. Round cups may be used by cutting channels to the outer mold cavities as shown in Figure Six. One may be surprised to find that the end molds fill before the center molds. This is explained by considering the fact that the glass falls directly upon the gates of the central molds and acquires a certain amount of set during the period of time required to get the mold under the plunger. This glass then resists the pressure of the plunger more than the hotter glass coming through the side of the gathering. Providing the central molds with larger gates will help to equalize this difference in filling.

Many small articles are required in large quantities, making more attractive the use of multiple molds. A multiple mold that is used extensively is shown in Figure Eight. This mold is usually spoken of as a nest mold. Each mold cavity is of equal distance from the well, making the filling of the mold practically uniform. Some objects are so small that they must be released from the mold almost instantly to prevent the formation of magic blisters. To accomplish this purpose the spring bottom mold is brought into use. The operation of the mold may be worked out from the plan and section as shown in Figure Seven. The glass is placed in the font, weight of the spring cage seats the shell A upon the mold bottom B and the continued movement of the plunger forces the glass into the mold cavities. As the plunger is released the weight of the spring cage is removed from the font and the springs on the mold lift the shell off the mold bottom thus exposing one side of the article to the air so that the skin may reheat and the article cool more slowly. While this may permit the formation of a slight depression on the face of the ware the formation of the magic blister will be prevented. The font is removed from the shell by

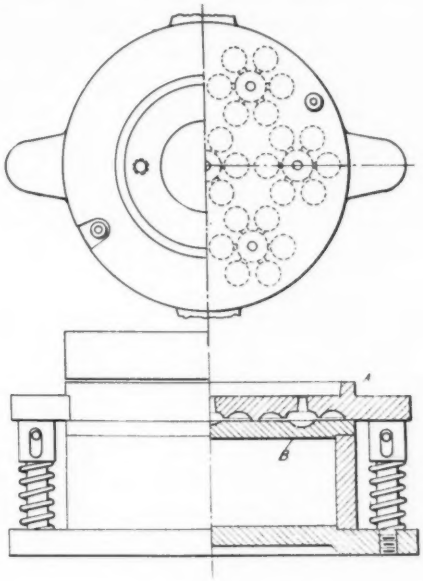


FIG. 7

means of a blunt instrument and the sprues with their nests shaken into a sand box. While it may reduce the capacity of the mold somewhat, the center cluster may be replaced by a valve that assists in removing the font and shelling out

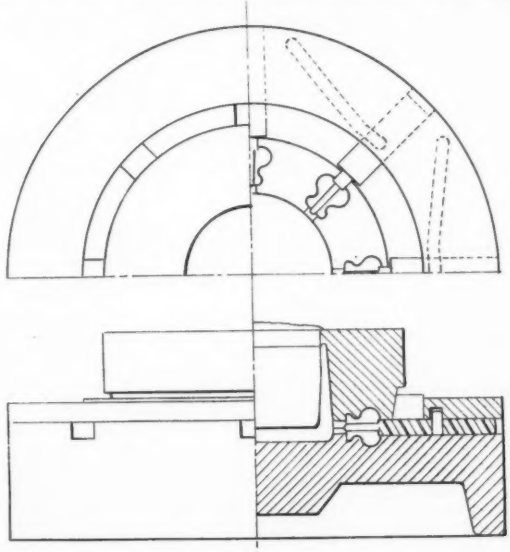


FIG. 8

the ware. A mold of this type may be worked at a speed of one hundred and twenty to one hundred and fifty mold-fulls per hour, making the daily production of the article run into almost unbelievable figures.

Some rather delicate and intricate articles, such as spark-plug insulators, percolator handles and so forth have been made in font molds. These have been perforated for wiring

or bolts and are made in either nest molds or vertical sectional molds. The important feature of these molds is a means of quickly removing the pin that forms the hole in the glass. In the vertical mold the pin may be operated by means of a "shovey-up" but in the nest type molds a more complicated cam arrangement may be used as shown in Figure Eight. A small movement of the cam ring pulls the pins out into the open where they may be cooled, inspected and if necessary oiled. In laying out a mold of this type it is better to place the article so as to cause the glass to flow along the pin rather than across the pin as a lap will form where the stream of glass reunites.

Laps will form in comparatively large articles where back pressure has to be depended upon to make the fill. In vertical molds these are more pronounced than in horizontal and where the laps would be very objectionable a mold should be designed to fill from the bottom.

In laying out a mold for an article upon which a delicate or sharp design is to be molded, care should be taken to place the design in such a position that the glass coming through the gate first will not fall upon this design, as this glass is somewhat colder and has a thicker skin than the glass that follows. This colder glass will not take as sharp an impression as the hotter glass. This will disfigure the article and where the design is used to produce optical effects the usefulness of the article may be destroyed.

The Manufacture of Laminated Safety Glass

A Review of the United States Patents Relating to the Manufacture of Transparent, Reinforced, Non-scatterable Glass

By Joseph Rossman[1]

Part II

INTENSE interest is being manifested in various quarters in all new developments in the laminated safety glass field. Not only are the plate and sheet glass trades on the alert but intensive investigations are being conducted by banks, financial research organizations and others interested in the new industry, to determine the present and what probable future conditions will prevail and whether the industry will offer a safe, permanent and profitable field for investment by their clients. It is not beyond the possibilities that practically all motor cars will some day be equipped with safety glass. So far as is known, only one little cloud has appeared on the new laminated glass industry's horizon, a cloud apparently, as yet, "no bigger than a man's hand"—patent litigation.

(*Continued from January, 1929 issue*)

The Shuman Machine and Process

A process of making composite sheets of a more or less translucent character is disclosed in U. S. patent No. 1,324,361, Dec. 9, 1919, which consists of assembling two sheets of glass and a sheet of celluloid between them, inclosing the assembled sheets within a closed compartment, surrounding the closed compartment with a fluid, exhausting air from out of the closed compartment and from between the sheets therein, heating the fluid to raise the temperature of the compartment until the celluloid becomes softened, then increasing the pressure of the fluid and causing it to apply pressure through the walls of the compartment upon the outer surfaces of the two sheets of glass to press them tightly upon the softened celluloid whereby they are thoroughly welded thereto throughout their entire contacting surfaces, then lowering the temperature of the fluid and removing the pressure therefrom, and finally admitting atmospheric pressure to the compartment and removing the composite sheet from the compartment.

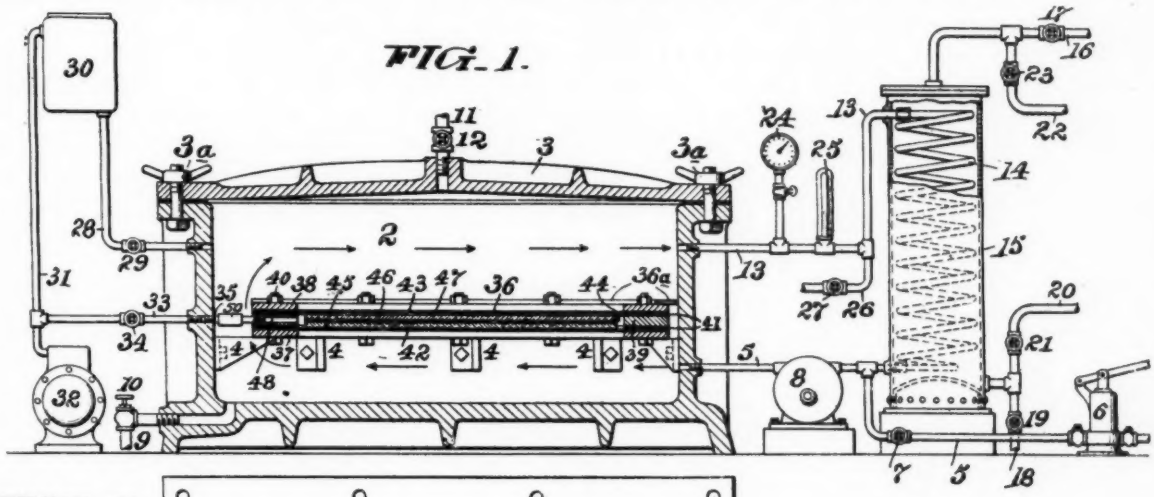
Figure 1 is an elevation of the apparatus with the compartment and chamber in section; Fig. 2 is a plan view of it with part in section; and Fig. 3 is a view of it with part in section; and Fig. 3 is an enlarged sectional view of a portion of Fig. 1.

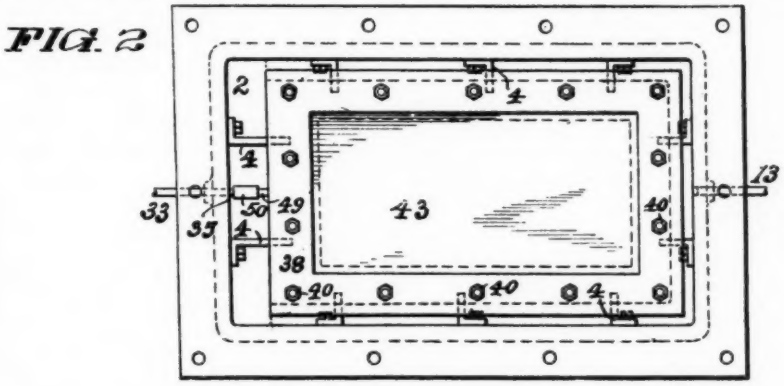
Briefly stated, the process of operation for welding together the two sheets of glass 45 and 46 to an intermediate sheet of celluloid 47, is as follows: The sheets of glass, preferably with their contacting surfaces perfectly clean, are placed upon opposite sides of a clean sheet of celluloid 47, and these sheets are then placed within the frame 36 after the top plate 43 and frame 38 have been removed. These parts are then placed in position and the bolts 40 inserted and tightened so as to make the chamber 44 airtight except so far as communication may be had through the nozzle or tube 49. This frame 36 thus charged with the glass and celluloid is then placed in the tank and rests upon the lugs 4 and preferably with the greatest clearance between the end of the frame and the side of the tank at the end most distant to where the water is circulated through pipe 5. When the frame 36 is placed in position in the tank, the pipe 49 is coupled to the nipple 35 by the double union 50.

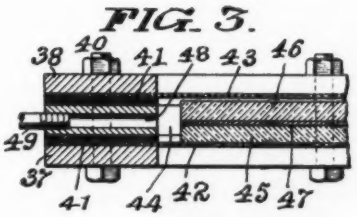
The valve 10 being closed and the cover 3 being tightly clamped in place, water is admitted by the pipes 26 and 13 into the tank. The air within the tank is allowed to escape through the vent 11, the valve 12 of which has been opened. The water fills the tank as well as the pipes 13, 5 and coil 14, and will also fill the circulating pump 8, and if the valve 7 is opened, the water may extend all the way back to the pressure pump 6. When the water begins to flow from the overflow pipe 11, the valve 12 is closed, the valve 27 is also closed, and the vacuum pump 32 put into operation with valves 29 and 32 put into operation with the valves 29 and 34 opened. When the desired degree of vacuum has been put upon the chamber 44 and also upon the water in the tank 2, the valve 29 is closed and the valve 34 may also be closed or, if desired, valve 34 may be left open and the vacuum pump continue to act in maintaining the vacuum within the chamber 44. Any suitable well known means may

[1] Patent Examiner United States Patent Office, Washington, D. C. Chemical Engineer, Member of the District of Columbia Bar.

be employed to indicate the extent of vacuum. After the removal of the air, additional water is pumped into tank 2 by means of the pump 6 until the pressure of the gage 24 indicates about ten pounds. The valve 7 is then closed and the entire fluid contents of the tank and pipes are started into circulation by the circulating pump 8. The circulation enters the tank by pipe 5 passing under the frame 36 to the distant side, thence upward around the end of the frame







and back over the frame and thence out by the pipe 13. To insure this circulation to the extreme end of the frame 36, a loose filling plate 36ª may be allowed to rest upon the top of the frame 36 closing the space between the tank and frame at its sides and end nearest to the pipes 5 and 13, as indicated at 36ª in Fig. 1, and in dotted lines in Fig. 2. The fluid from the pipe 13 passes through the coil 14 and back to the pump 8. During this circulation, steam is turned on to the tank 15 by valve 17, and in passing over the coil 14 gives up its latent heat to the circulating water within the coil and the condensed water passes to the bottom and out by pipe 18 and valve 19. The temperature of the circulating fluid is gradually raised until the fluid is heated to about 230°F. This temperature of the fluid is conducted to the glass and celluloid and softens the latter, while held under the gentle pressure of ten pounds per square inch. The temperature of the circulating fluid may be observed by the thermometer 25 and in this manner regulated as may be required. After the temperature has reached about 230° F., and while the fluid is still being circulated by the rotary pump 8, a small additional amount of fluid is pumped into the system by the pump 6, the valve 7 being temporarily opened for the admission of this additional fluid. This addition of the circulating fluid is made very gradually and until the pressure gage 24 indicates a pressure of about one hundred pounds (by way of example). This increased pressure is therefore applied to the celluloid between the two glass sheets and at a time that the celluloid is softened by the temperature of the circulating fluid. After a reasonable length of time to insure full setting of the glass and celluloid into thorough and intimate contact (which may be from five to thirty minutes, according to the thickness of the glass), the steam is shut off by the valve 17 and valve 19 is also closed. Cold water is then admitted by valve 21 and allowed to overflow by opening the valve 23. This cold water flows over the coils 14 and cools the circulating fluid, the latter still being circulated by the rotary pump 8. In this manner, the circulating fluid is cooled until the thermometer indicates about 100° F., which is sufficiently low for handling and removing the glass.

After the circulating fluid and the glass within the frame 36 have thus been cooled, the pressure is gradually released by opening the overflow valve 12 until atmospheric pressure is within the tank 2. The drain valve 10 is then opened, and the fluid contents run off from the tank 2 by the drain pipe 9, or at least sufficiently low to expose the frame 36 containing the glass and celluloid. The cover 3 of the tank 2 is then removed. The vacuum valve 34 is then closed.

The frame 36 is then lifted out, having been disconnected from the rubber tube 50. The vacuum is thus broken within the chamber 44. The frame 36 may then be opened by removing the nuts from the bolts 40 and lifting off the upper frame 38 and its flexible metal sheet 43. The composite glass and celluloid sheet is then removed.

The particular steps of the process may be varied. For instance, if the composite sheet is to be of medium area and be formed of thick glass, the entire pressure may be promptly applied even before the heating of the glass and celluloid takes place, or the heating and the pressure may be applied at the same time. In order to insure a proper weld between the celluloid and the glass, it is essential that the celluloid shall be heated so as to be softened and conform to the general surface of the glass at the time that the pressure is being applied, but its immediate time of application may be before or during the application of such welding pressure. In the case of thin sheets where the glass might readily crack it is preferable to first apply the temperature to soften the celluloid before applying the welding pressure. It is also to be understood that while it is preferable (where thin sheets of glass are employed) that there shall be a preliminary low pressure applied to the glass and celluloid sheets before the celluloid is softened, and before the application of a full pressure, this preliminary low pressure may be omitted where desired, and especially where the glass sheets are relatively thick.

While it is most desirable that the two sheets of glass and an interposed sheet of celluloid are alone employed, it will be manifest that the same process may be carried out where the glass surfaces to be welded are first painted or coated by painting or spraying with a very thin layer of celluloid dissolved in a solvent which, for example, may be a mixture of 95% alcohol and 5% crystallized camphor, and when dry placed upon opposite sides of a sheet of celluloid with their painted or coated surfaces in contact therewith. A coating of this kind sticks very tightly to the glass; and after all of the solvent has been evaporated (which may be assisted by high temperature or otherwise), the remaining deposit is pure celluloid as a thin skin on the glass and very tightly adherent thereto. As celluloid will weld somewhat better to celluloid than it will to glass, this pre-treatment of the glass to obtain a very thin skin of pure adhering celluloid is an advantage to the process and the product, and forming subject matter of Patent No. 1,274,206, dated July 30, 1918, and No. 1,274,205, dated July 30, 1918.

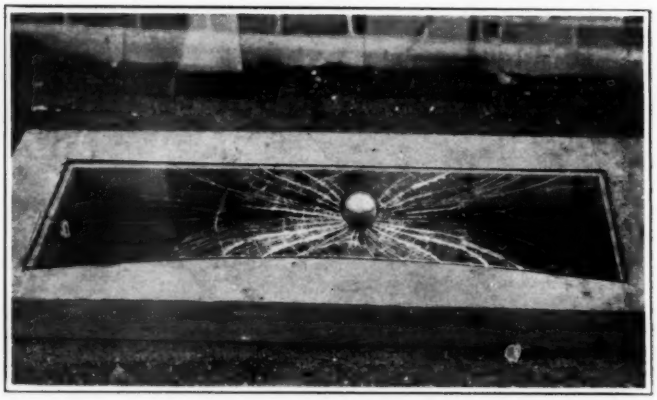
The Mascart Patent

The process described in U. S. patent No. 1,342,267, dated June 1, 1920, consists of reinforcing glass which comprises forming a film of gelatin upon the face of a sheet of glass from a gelatin solution, permitting the film to dry, and then superposing on the film a film of cellulose ester in the form of a solution, the solvent employed being common to both the gelatin and the cellulose ester, whereby an intimate union between the films is secured, permitting the film to dry and then pressing a relatively strong sheet of cellulose ester against it in the presence of heat, the adherent surface of the sheet having been previously treated to more readily unite with the films under the pressure exerted.

In order to carry out the invention, on the top of each layer of gelatin a solution of nitrocellulose celluloid or other

THIS IS THE WAY LIBBEY-OWENS LAMINATED OR NON-SHATTERABLE GLASS IS TESTED

A CLOSE-UP VIEW OF A WINDSHIELD OF LAMINATED, OR NON-SHATTERABLE GLASS AFTER IT HAS BEEN TESTED BY DROPPING A 4-POUND STEEL BALL ON THE GLASS FROM A HEIGHT OF 7 FEET.



Illustrations by courtesy of "The Engineer," published by Lockwood Greene Engineers, Inc., New York

ester of cellulose (acetate of cellulose) is uniformly spread and allowed to dry. The layer of cellulose thus obtained, strongly adheres to the gelatin, more particularly if a solvent has been used which is not very volatile, such as amyl acetate, but in order to insure satisfactory adhesion in every case, whatever be the state and the nature of the gelatin, it is necessary to add to the solution of the cellulose ester a small proportion (about 10 to 20%) of various substances which have the property of being common solvents for gelatin and for the cellulose ester, such for instance as acetic acid, acetamid or formamid.

For completing the manufacture of the reinforced glass two glass sheets which have been prepared, as described above, are dipped into alcohol of strength about 90% and after being exposed to a temperature of about 60 to 70° C. are pressed one against the other, or before pressing the sheets together there may be inserted between them a sheet of celluloid or some other ester of cellulose. Experience has shown that very satisfactory results can be obtained even with hard gelatin or gelatin which has been hardened or rendered insoluble by dipping sheets of glass previously covered with gelatin by spreading as already mentioned, directly into alcohol of about 90% strength mixed with one or more common solvents for gelatin and celluloid or esters of cellulose (acetic acid, acetamid, formamid, etc.), for instance, for dissolving an ester of cellulose in the proportions indicated of about 10 to 20%. This direct dipping into alcohol prepared in this way takes the place of the spreading of the alcohol solution; it is then sufficient to press the sheets of glass against a core of celluloid or other cellulose ester inserted between them, the temperature conditions above referred to being observed.

Another improvement which contributes to the increased adhesive power of a celluloid sheet to gelatin consists in mechanically or chemically treating the surface of the celluloid sheet. In the first case, the surface is slightly roughened, for instance by means of a sand blast. In the second case, a reducing reagent, for instance an alkaline sulfid or any of the reagents proposed for denitrating nitro-cellulose, is used. The sheet of cellulose thus mechanically or chemically prepared strongly adheres to a sheet of gelatin when the two sheets are dipped into alcohol and pressed against one another, at the same time being exposed to the action of heat. This feature of mechanically or chemically treating the celluloid sheet forms the subject of a divisional patent No. 1,342,268.

A modification of the process is as follows: After the surface of the sheet of cellulose ester has been attacked it is dipped into a hot solution of gelatin and left to dry. The sheet which is thus coated with gelatin on both sides, is after drying dipped into alcohol and pressed between two sheets of glass or two sheets of glass coated with gelatin, under the action of heat, as stated above.

In all the cases reinforced glass, comprising two sheets of glass and a celluloid core stuck to the glass by means of two layers of gelatin is obtained; this product, however, has the peculiarity of perfect adherence of the various portions to one another, even when the layers of gelatin and celluloid deposited, are exceedingly thin (for instance 0.001 mm.).

In the same way there could be manufactured reinforced glass comprising any desired number of glass plates, both greater and less than two.

More particularly, when it is desired to manufacture a product consisting of a single sheet of glass, to which is glued, by means of gelatin, a sheet of celluloid, it is sufficient to stop the operation at the moment when the cellulose layer has been spread on the layer of gelatin. If it is considered that this layer is not sufficiently thick, then one or more layers obtained in the same manner could be superposed on it.

Glass prepared in this manner has a solidity which makes it a real reinforced glass, suitable for certain applications. If the gelatin has been suitably hardened and rendered insoluble, it resists the action of water and heat, and can be used just as it is. The layer of cellulose must not be too thin; it must be at least 0.1-0.2 mm. thick in order to form a sufficiently strong core. Finally, as this core is exposed, it is very important that it should be incombustible. It is therefore advisable, more particularly in this special case, to make it of cellulose acetate.

Higher Alcohols as Solvents

In practicing the invention of U. S. patent No. 1,421,974 a solvent composition is employed, consisting of one of the higher alcohols combined with one or more ingredients. For instance, an active solvent such as propyl, butyl, or amyl alcohol or their mixtures, may be combined with one or more ingredients such as camphor plus most any of the essential oils, especially oil of citronella, oil of cloves, or methyl salicylate, the ingredients being capable of retarding the softening effect of the active solvent. Excellent results have been secured by a composition consisting of fusel oil 83⅓% and methyl salicylate and camphor 8⅓% each. These proportions vary with the character of the work to be performed in that the proportion of the fusel oil will either be reduced or increased and the combined proportion of the other ingredients correspondingly varied. It is preferred to use the essential oils and camphor in equal quantities under most conditions, but this is not always desirable. Whatever the changes in proportions may be, they are governed largely by the temperatures at which the solution is to be worked, and conditions encountered in the manipulation of the articles to be cemented, such as the temperature of the articles and atmospheric conditions generally. The varying conditions render adjustments necessary to suit those conditions.

The base, fusel oil (which for commercial reasons is most generally used in preference to the individual higher alcohols) is also mixed with other ingredients for special results. For example, if still greater bond is required than is obtained by the composition above described, certain of the coal tar preparations are used, especially aniline, xylol, toluol, and (or) naphthaline. Amines of various bodies and ammonia itself are also used for certain color effects. A small proportion of an amine for example, also increases the permanency of resistance of the laminae to disintegrating atmospheric effects. Any of these substances may be used with or without camphor and essential oils in making up the working condition.

In practice, the glass and celluloid to be united are immersed in the solution above described, the solution being maintained at a temperature best adapted to working conditions. The temperature will vary to conform to atmospheric conditions, but the temperatures which have been found most satisfactory for operating on a commercial scale are between 24 degrees and 35 degrees centigrade. The article, consisting of assembled laminae of glass and celluloid, after being removed from the solution is subjected to elevated temperatures for a very short period (a few seconds), after which pressure is applied to the extent required for expressing excess of solution and eliminating all air bubbles, and to cause complete and close contact and adhesion of the surfaces to be bonded together, the heat being increased during the period of pressure. There is practically no action of the solution when the article is first dipped, and the increased temperature before pressure is for the purpose of rendering the solution sufficiently active to obtain the utmost bonding action. Inasmuch as the solvent properties of the solution are controlled by its temperature, it is possible to retard its action to any required degree, thereby avoiding all likelihood of marring of the celluloid or the formation of bubbles. In order to obtain the best results, the ingredients of the solvent composition should be in the highest possible state of purity, so as to avoid the production of a dirty finished product which will require cleaning, and to insure against any tendency of the bond to weaken and let go after a long exposure to the elements. By the use of pure ingredients, the leaving of gummy substances in the machine and the consequent necessity of frequent cleaning are also avoided.

Out of an abundance of caution, to prevent any possibility of separation of laminae, it is advisable after the welding operation has been completed, to immerse the article in a bath of linseed oil and a gum, such as kauri, which is maintained at an elevated temperature. This solution acts upon the exposed edge of the celluloid to form a coating which protects the article against disintegration by atmospheric action.

Non-Actinic Safety Glass

Several patents have been granted for safety glass which will not discolor when exposed to light. According to U. S. patent No. 1,467,030, Sept. 4, 1923, the objectionable coloration of the plastic material in reinforced glass may be prevented by using, in place of the ordinary window glass or plate glass heretofore employed, a special glass of such a nature that it will not transmit the actinic rays of light, or at least the more powerful actinic rays such as the ultraviolet.

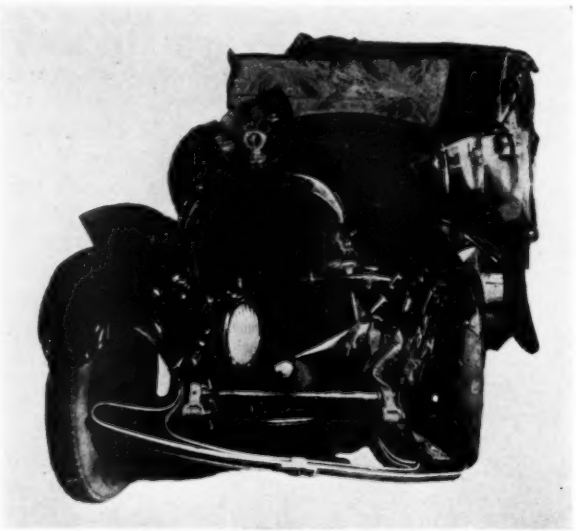
It has been found that the actinic, or ultraviolet rays are the principal cause of development of color, of brittleness, and of acidity in plastic such as pyralin when exposed to sunlight. When these ultraviolet or actinic rays are screened out or absorbed by passing the sunlight through glass of special composition, the remaining sunlight produces little or no change in, or development of color, development of brittleness, or development of acidity in plastics such as pyralin. A fundamental action of ultraviolet or actinic rays is to cause decomposition of the cellulose esters, such as cellulose nitrate or cellulose acetate, contained in the plastics.

Glass compositions having opacity to ultraviolet rays are well known and are available in various forms as articles of commerce. Three examples of suitable glass compositions are given as follows:

A soda glass flux is preferably separately prepared by fusing together the following ingredients:

Sand (SiO_2)	61.00%
Sodium carbonate, anhydrous	25.50%
Sodium nitrate, recrystallized	5.00%
Calcium carbonate, precipitated	7.20%
Borax	0.75%
Arsenic trioxide	0.55%
Total	100.00%

This composition, which may be designated "soda glass flux A," is fused with certain salts or oxides in certain proportions as indicated below to produce the desired glass composition.



By courtesy of Triplex Safety Glass Co. of America

THE TRIPLEX WINDSHIELD PROVED ITS VALUE IN THIS DISASTROUS NEW JERSEY CRASH

EXAMPLE 1.

Soda glass flux A	83.00%
Cerium nitrate, crystallized	17.00%
Total	100.00%

EXAMPLE 2.

Soda glass flux A	90.00%
Cerium borate	8.13%
Nickel sulphate, crystallized	0.07%
Uranoso-uranic oxide	1.80%
Total	100.00%

EXAMPLE 3.

Soda glass flux A	92.00%
Ferrous sulphate, crystallized	8.00%
Total	100.00%

Glasses approximately equal in ultimate composition to those described above, and of equal value may be made by

fusing at once all the raw materials rather than making the soda glass flux and then fusing this with the salts and oxides which are used to impart special qualities.

The Use of a Ray Filter

In accordance with the invention of U. S. patent No. 1,604,761, Oct. 26, 1926, actinic-ray-absorbing or arresting ingredients are incorporated in the safety glass structure. These ingredients may be, for example, beta-methyl umbelliferone, acetamino quinolin, aesculine, anethol, quinine sulfate, ferric chloride, potassium dichromate, nickel chloride in combination with aluminum chloride or calcium chloride, salts of certain metals of high molecular weight such as cadmium, molybdenum, thorium, cerium, uranium and other or various combinations of these. A variety of colors stable to sunlight and which when compounded in an actinic-ray filtering stratum produce amber, yellow, orange, as well as violet, red, green, and blue, may also be used. The principle involved is that the ingredient used must be capable of reflecting or absorbing actinic light without objectionable deterioration or change in molecular structure of any of the portions of the safety glass, as the ingredient itself, the strengthening sheet, the glass, or the vehicle carrying the ingredient.

As an example of the practice of the invention, there may be used two sheets of glass of a desired thickness, a strengthening sheet of pyroxylin plastic approximately .020″ thick there between, and a ray-filter stratum of pyroxylin plastic, gelatin, or other bonding material about .0005 to several thousandths of an inch thick between the strengthening sheet and one of the glasses. The strengthening sheet is made with sufficient color, of the necessary kind, to neutralize the color given to the screen by the addition of sufficient non-actinic ingredients to arrest the actinic rays of the sun. The color of the strengthening sheet, therefore, depends upon the color of the filtering screen necessary to filter actinic rays.

A product, comprising a central strengthening sheet with a ray screen and a sheet of glass on each side, and made as indicated below, gives satisfactory results:

(1) Approximate composition of strengthening sheet .020″ thick. (Parts by weight.)

	Parts
Nitrocellulose	73.
Camphor	25.
Volatile solvent (alcohol)	1.5
Urea	.5
Ultramarine	.003
Violet lake	.001

(2) Approximate composition of ray filters in the character of binding layers, each .0005″ thick. (Parts by weight.)

	Parts
Gelatine	2.5
Water	97.5

(Vehicle for carrying actinic ray-arresting ingredient and binding glass to strengthening sheet.)

Ferric chloride..... .25 part

(Actinic ray-arresting ingredient.)

Bichloride of mercury..... .01 part

(Germicide.)

(3) Glasses: each of ordinary plate glass composition ground to approximately ⅛″ thick.

(4) To composite, spray a binding layer on one side each of the two previously cleaned glasses and permit to dry. Place the strengthening sheet of pyroxylin plastic between the gelatin coated faces of the glass, heat the entire stack in a hydraulic press between felt pads to a temperature of approximately 120° C., and press for 15 seconds with about 500 pounds of pressure per square inch on the glass. Cool in the press while pressure is maintained. (The press plates may be heated by circulating steam and cooled by circulating water.)

Oil Resin Varnish as Ray Filter

The protective coating must not only be resistant to sunlight but also must itself be waterproof, tough, and resistant

By courtesy of "The Engineer," published by Lockwood Greene Engineers, Inc., Engineers, New York.

LOOKING DOWN ON THE NEW LIBBEY-OWENS LAMINATED GLASS PLANT AT TOLEDO

The picture is taken from the roof over the packing and shipping departments. This view shows the backs of the sawtooth roof sections and the ventilators in every section. The railroad track runs into the receiving department. The windows opening on the areaway at the left provide light for the basement under the pressroom.

By courtesy of "The Engineer," published by Lockwood Greene Engineers, Inc., New York

INTERIOR OF THE LIBBEY-OWENS SHEET GLASS COMPANY'S NEW LAMINATED GLASS PLANT TAKEN BEFORE MACHINERY WAS INSTALLED

There are no columns, leaving all space free for manufacturing. The sawtooth roof faces north for the best lighting effect. The pressroom is in the foreground; cutting and washing departments in the background.

to weather and must present when dry a hard polished surface. It should also be clear and at least nearly colorless. A good oil-resin varnish is used in U. S. patent No. 1,647,435 dated Nov. 1, 1927, of which the following is a typical example: copal resin, 1 part by weight; linseed oil, 1.5 to 2.5 parts by weight; spirits of turpentine, 3 to 5 parts by weight.

In preparing this varnish, the copal resin is melted at as low a temperature as possible, the hot linseed oil added and the mixture stirred continuously, while maintaining a temperature of about 210° C.; a small quantity of manganese borate may be added as a drier. After the mixture is nearly cool the turpentine is added.

A good spar varnish, such for example as "navalite," several of which are on the market, will also answer the purpose admirably. Examples of other varnishes are damar-oil varnish, various spirit varnishes, and phenol condensation product varnishes such as condensite and bakelite varnishes.

The method of applying the protective coating is immaterial; spraying with a so-called air brush or atomizer is good although it may be applied by dipping, pouring, printing from a roll or brushing. The coating may be applied as desired, for example, over the entire surface, as to both sides of a sheet, and may be relatively thin, say 0.0005 to 0.0015 inch thick when dry.

The particular composition of the plastic *per se* is not of primary importance; any of the various cellulose plastics, containing an ester, for example nitrate or acetate, whose protection is desired may be employed. An example of cellulose nitrate plastics is pyralin. A typical formula for nitrocellulose plastic is (parts by weight):

Nitrocellulose	75.
Camphor	23.
Urea	.5
Residual solvent	1.5

The ingredients may all be varied considerably without affecting the result. Camphor may be replaced by the so-called camphor substitutes of which examples are triacetine, ethyl acetanilid, diethyl phthalate. Urea may be replaced by other substances which will fill its function of a stabilizer.

The nitrocellulose plastics may be made by any of the usual and well-known methods. The cellulose (paper or cotton) is treated with nitric and sulfuric acids, washed, dehydrated before or after admixture of camphor or substitute, alcohol added to the mixture which is kneaded in mixing machines or on mixing rolls, pressed into a block and then sheets sliced off. Or the cellulose after nitration may be dissolved in suitable volatile solvents and cast on a metal wheel or moving belt and the film stripped after drying. In the latter case the surface is already polished, while in the former case the polish is obtained by pressing the sheets with heat between polished metal plates. The sheets may be clear and uncolored in which case they have the usual slightly yellowish color of nitrocellulose plastics, they may be tinted with blue to resemble glass color or they may be colored to any desired hue such as green, brown, blue, etc., either during or after the manufacture of the sheets.

(To be continued)

American and Foreign Patents on Safety Glass

Useful Lists for Those Interested in the New Development

By Joseph Rossman[1]

United States

J. Wood 830,398. Sept. 4, 1906.
E. Benedictus 1,098,342. May 26, 1914.
E. Benedictus 1,128,094. Feb. 9, 1915.
Bugbee 1,153,859. Sept. 14, 1915.
E. Benedictus 1,182,739. May 9, 1916.
E. Benedictus 1,206,656. Nov. 28, 1916.
A. Roosevelt 1,210,987. Jan. 2, 1917.
A. Bardin 1,223,135. Apr. 17, 1917.
Hitchcock 1,223,583. Apr. 24, 1917.
O. Goetzke 1,224,530. May 1, 1917.
A. Bardin 1,228,165. May 29, 1917.
C. & V. Shuman 1,274,205. July 30, 1918.
Shuman 1,274,205. July 30, 1918.
Shuman 1,274,206. July 30, 1918.
King 1,285,266. Nov. 19, 1918.
C. & V. Shuman 1,324,361. Dec. 9, 1919.
Bartelstone 1,334,588. Mar. 23, 1920.
Tillyer 1,340,189. May 18, 1920.
L. F. Mascart 1,342,267. June 1, 1920.
L. F. Mascart 1,342,268. June 1, 1920.
Shuman 1,355,625. Oct. 22, 1920.
Marchworth 1,421,974. July 4, 1922.
V. C. Edwards 1,467,030. Sept. 4, 1923.
H. Rosenthal 1,478,862. Dec. 25, 1923.
Mascart 1,512,267. June 1, 1920.
Bull 1,539,239. May 26, 1925.
C. Shuman & A. Worrell 1,548,490. Aug. 4, 1925.
W. C. Bull 1,553,667. Sept. 15, 1925.
G. B. Riley 1,560,321. Nov. 3, 1925.
W. C. Bull 1,575,969. Mar. 9, 1926.
J. H. Sherts 1,604,761. Oct. 26, 1926.
L. Bartelstone 1,611,139. Dec. 14, 1926.
W. C. Bull 1,632,363. June 14, 1927.
E. Hope 1,644,131. Oct. 4, 1927.
E. S. Bock 1,645,580. Oct. 18, 1927.
J. H. Clemell 1,647,435. Nov. 1, 1927.
W. F. Brown 1,651,581. Dec. 6, 1927.
J. L. Drake 1,653,040. Dec. 20, 1927.
H. E. Allen 1,655,933 Jan. 10, 1928.
W. F. Brown 1,656,691. Jan. 17, 1928.
Owen 1,657,227. Jan. 24, 1928.
P. H. Head 1,665,413. Apr. 10, 1928.
L. Bartelstone 1,666,252. Apr. 17, 1928.
L. Bartelstone 1,667,832. May 1, 1928.
B. Long 1,668,853. May 8, 1928.
F. Fraser 1,669,044. May 8, 1928.
W. F. Brown 1,670,435. May 22, 1928.
W. F. Brown 1,670,436. May 22, 1928.
W. F. Brown 1,692,619. Nov. 20, 1928.
Randall 1,693,729. Dec. 4, 1928.
W. O. Lytle 1,698,371. Jan. 8, 1929.

Partial List of Foreign Patents

British

1,790 of 1910.
17,242 of 1910.
10,293 of 1911.
10,324 of 1911.
18,856 of 1911.
17,549 of 1912.
9,666 of 1913.
15,386 of 1913.
15,387 of 1913.
15,388 of 1913.
15,880 of 1913.
9,178 of 1915.
111,539 Dec. 3, 1917.
129,779 July 11, 1919.
131,714 Aug. 25, 1919.
175,044 Feb. 6, 1922.
221,552 Sept. 8, 1924.
237,179 July 23, 1925.
237,379 July 30, 1925.
254,668 June 28, 1926.
265,319 Feb. 10, 1927.
261,425 May 12, 1927.
267,428 Mar. 17, 1927.
279,671 Nov. 3, 1927.
288,782 Apr. 19, 1928.
290,144 May 10, 1928.

French

321,651 Sept. 16, 1902.
356,076 Sept. 21, 1905.
405,881 Nov. 25, 1909
addition 14,829.
439,644 Apr. 15, 1912.
addition 16,020 and 18,954.
463,800 Dec. 27, 1913.
addition 18,716 and 19,866.
464,348 Jan. 12, 1914.
467,303 Mar. 27, 1914.
496,511 Aug. 6, 1919.
524,263 May 10, 1921.
537,478 Mar. 4, 1922.
543,177 May 29, 1922.
597,669 Sept. 7, 1925.
621,736 Feb. 12, 1927.
622,664 Mar. 7, 1927.
631,008 Sept. 3, 1927.
638,253 Feb. 14, 1928.

German

234,150 Apr. 29, 1911.
236,013 June 24, 1911.
267,563 Nov. 22, 1913.
320,339 Apr. 15, 1920.
392,516 Mar. 21, 1924.

Austrian

62,521 Dec. 10, 1913.
55,038 Aug. 26, 1912.

Swiss

53,037 July 18, 1910.
116,769 Sept. 16, 1926.

Netherland

4,169 July 30, 1919.

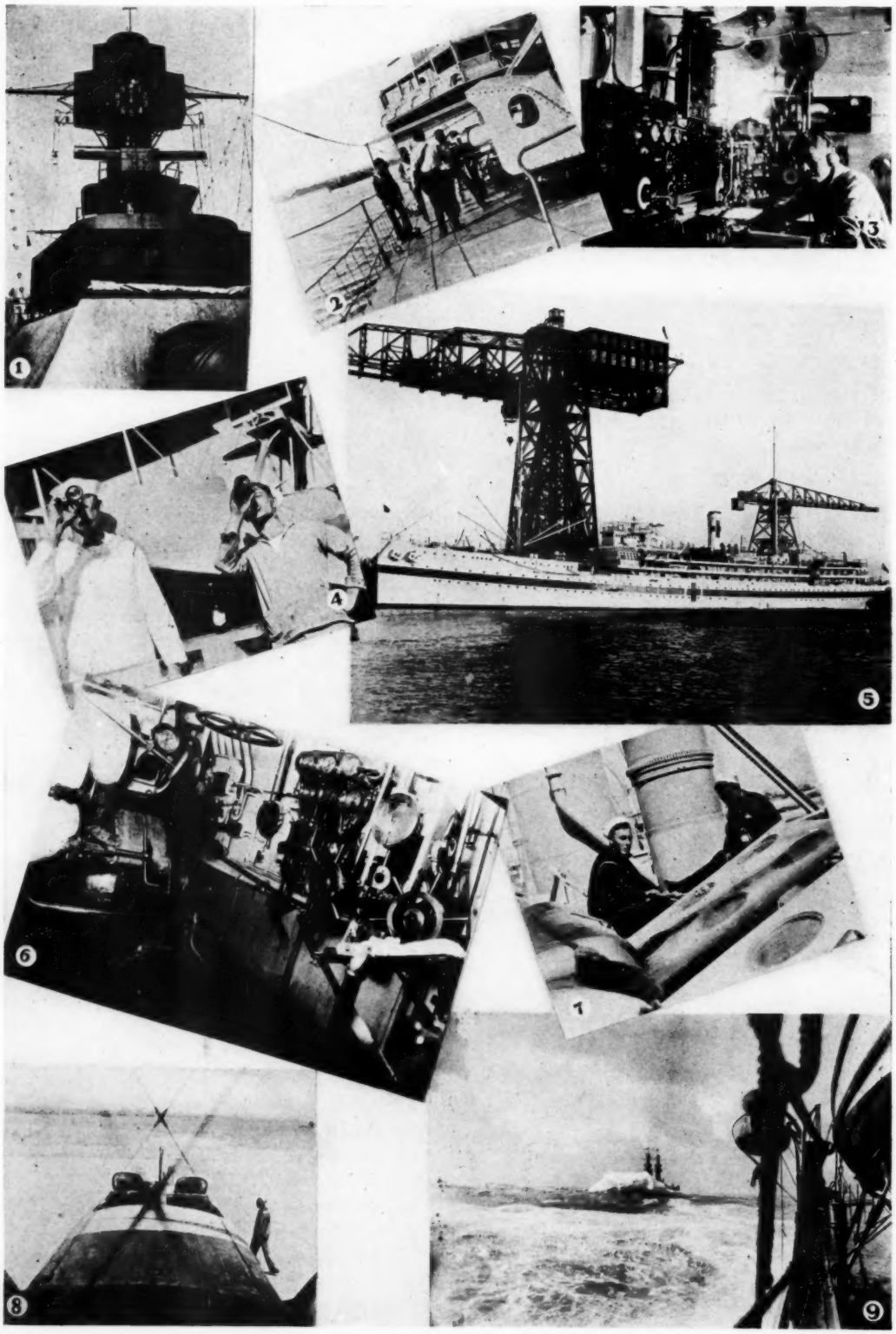
Norwegian

28,805 Mar. 21, 1914.

[1] Patent Examiner U. S. Patent Office, Washington, D. C.

Technologists Discuss Laminated Glass

The 112th meeting of the Society of Glass Technology was held in University College, London, on Wednesday, December 19, 1928, Mr. W. Butterworth, (Senr.) M.A., (President) in the chair. The following paper was communicated: (A) *"A Brief Outline of the History, Development and Methods Employed in the Manufacture of Laminated Glass."* By Mr. W. R. Lyttleton (Works Director of the Triplex Safety Glass Co. Ltd.) (1) HISTORY AND DEVELOPMENT. The principle of securing a tough material between two hard and relatively brittle sheets had long been known for decreasing splintering under impact. One of the pioneers to manufacture this type of glass was an Englishman, Wood. His efforts in 1905 were not wholly successful in marketing the product. About 1910, a Frenchman, Benedictus, met with more success, and La Societe du Verre Triplex, which manufactured his article is still in business. Similar efforts were made in America about the same time. Since the war, many firms in England and America, a few in France and Germany, and one in Czecho-Slovakia have manufactured this strengthened glass. The methods used varied considerably. (2) MANUFACTURE. A layer of nitro-acetate cellulose, as transparent and free from cloud or any defects as possible, is securely fastened to glass sheets. In order to give long service an adhesive cement is employed to hold the layers together. In one method of manufacture, in order to obtain a perfectly clean surface on the glass plates they are cleaned with rouge and washed in running water. When dry, the plates are evenly coated with a suitable gelatine solution, then this in turn is dried in warm filtered air. An enamel or varnish is applied to the dry gelatine. Two prepared sheets of glass and a suitable sheet of celluloid are then placed in an alcohol bath at a definite temperature; and assembled as a "sandwich" with the celluloid in the centre. The sandwich is then subjected to pressure in a hydraulic press, air bubbles and excess fluid being pressed outwards. In order to exclude moisture from the adhesives, the cellulose is "cut back" around the edges of the glass, and the space is filled with pitch, bitumen, varnish or paint. The laminated glass is then ground, polished, and prepared for use in the usual ways. Cellulose acetate and nitro-cellulose may discolor and become brittle, but use is made of high boiling point solvents to overcome this difficulty.



FIVE TONS OF GLASS USED IN CONSTRUCTION AND EQUIPMENT OF A MODERN BATTLESHIP IN ADDITION TO KITCHEN AND DINING ROOM AND HOSPITAL REQUIREMENTS

1. Non-shatterable plate glass in the upper works. 2. Reinforced glass stands the firing shocks. 3. Good glass in the radio room is essential. 4. The Navy is a big user of glass for this popular purpose. 5. Portholes equipped with wired glass. The hospital ship with its many windows is a large user of plate and flat glass. 6. In the power plant, the heart of the vessel, none but the strongest obtainable gauge and dial glass may be used. The engine room is fitted with laminated glass. 7. Glass in various parts of the ship keeps out the weather and lets in the light. 8. Glass protects the lights and instruments. 9. Firing dead ahead—a terrific test of the ship's equipment of glass.

The Navy and the Glass Industry

By G. K. Spencer

TO wage a sea battle successfully, it is necessary that the commander-in-chief be able to bring his ships to the place he has selected, and, once there, to be able to so maneuvre them that his guns can inflict the greatest amount of damage to the enemy, while at the same time he incurs the least possible damage to himself. It thus requires that each ship be absolutely reliable in respect to her ability to carry out these plans. The failure of a single ship to carry out her part of the program might cause such a disarrangement of plans as to materially change the outcome of the battle, with possible disastrous results to the country's future.

It can thus be seen how extremely important it is for the machinery which enables the ship to maintain her proper place in the battle or scouting line to be as perfect as it is humanly possible to make it. We may well remember the old story of the battle that was lost for want of a horseshoe nail.

And this is particularly true of the several tons of glass used aboard modern ships of the battle line. Because of this fact every care is taken by the Navy to insure that its gauge glass, its porthole glass and its tubing be of an ever more perfected type. To this end, the Navy is willing to advance to manufacturers all the advantage of its wide experience with the use of glass products under conditions of shock. In recent years, this Naval information has been of the greatest value, and at least four large manufacturers have maintained the closest possible liaison with the Naval Bureau of Engineering, while others have continually availed themselves of the bulletins issued through some of the sections of this bureau.

With the Naval atomizers burning 5,000 pounds of oil to the hour each, instead of the 500 pounds formerly burned, the heats produced are now so extreme that all glass utilized for boiler gauges must be of the highest procurable type. This fact, alone, has caused two leading manufacturers to produce a glass suitable for this work, and they are now supplying their product to the navy, not only for battleships, but for the entire new light cruiser construction.

It follows, of course, that the practical development in the Navy will prove to be of the greatest value to the mercantile marine, as the vessels of this service also add to their high speeds through the intensification of boiler heat and the forced combustion of ever greater quantities of oil.

Tests are frequently made at sea, to determine the strength of various glasses in the ship's organization. Some time ago, a ship of the navy, the U.S.S. Nevada, fired her guns dead ahead in order to find the damage such firing would do to the installations of a modern battleship. Firing dead ahead is not habitually done by ships of war today, of the battleship class, because there is no way to take up the recoil except within the ship itself. It is the same as though the ship were struck by fourteen inch projectiles. By firing to port or starboard, the ship can heel over in a long roll and the sea assists in taking up recoil. But by firing dead ahead, the ship must absorb this recoil in herself; manifestly she can not roll backwards.

With volunteers in the gun turrets, the Nevada fired dead ahead. An immediate inspection demonstrated that the only glass which had carried away was that in the ship's bulletin boards. The work of the American gauge glass manufacturers had been so perfectly done that nowhere in the ship had gauge glass carried away or even cracked.

The above was, of course, a deliberate test. But the destruction of seven United States destroyers at Honda Head, California, in 1923 was more to the point, perhaps. These ships hit the rocks hard during night maneuvres in the fog. Though the vessels were known to be totally beyond salvage, yet naval engineers donned diving equipment and went into the ships to ascertain what they could about the ability of the ships' gear to withstand such shocks. Their investigations revealed that in no case had gauge glass carried away or cracked, which had been manufactured in the United States later than 1920.

With the modernizing of the battleships, U.S.S. New York, Texas, Florida, Arkansas, Utah, Oklahoma and Nevada, the latest developments in the glass making industry were installed, and complete new gauges placed in the engineering departments. This was necessitated by the changing over from coal combustion to oil combustion in four of the vessels. Non-shatterable glass was placed in the electrical gauges. It was guaranteed by both the engineers of the navy and the manufacturers to withstand any aerial bombing likely to reach it in actual naval war.

From the wired-glass portholes to the gauges and nonshatterable glass of the engine rooms, and the nonshatterable plate glasses of the upper works, a total tonnage of five units is included in the displacement of a modern battleship of the line. Five tons of manufactured glass! In one ship! Then consider the three hundred odd vessels of the Navy's fighting forces, and it can be seen just what a glass consuming organization the sea force of the United States is.

But this does not tell the story completely even yet, for there is now in progress a distinct movement toward using glass for many non-military utilities, such as in the navy's cookery and in the preparation of foodstuffs, the medical officers having determined that in the work of preparing food, the containers can be kept more sanitary if made of glass, and thus tend to obviate food poisoning of any kind. Naval Training Stations have already discovered the value of this kind of cooking and preparing vessel, and in at least several destroyers glass cooking vessels have already been in use. This field, alone, should represent a valuable one for the future, its military benefits being already determined beyond doubt. Doubtless, the army too will have some returns to make on this aspect.

Glass Industry

ESTABLISHED 1920

The First Trade Journal Devoted Primarily to Glass Technology, Engineering, Raw Materials and Glass Factory Equipment and Operation

Published Monthly

Copyrighted, 1928, by

GLASS INDUSTRY PUBLISHING COMPANY, INC.

50 Church Street, New York

Telephones { Cortlandt 2465 / Cortlandt 2466 — Cable Address, Glasdustry

J. B. KRAK, Technical Editor

Subscription Price .....$2.00 a Year
Single Copy .....20 Cents

THE GLASS INDUSTRY circulates extensively among American and foreign glass manufacturers, their business executives and technical and factory operating staffs.

Vol. 10 FEBRUARY, 1929 No. 2

CONTENTS

	Page
Die-Casting Glass	25
The Manufacture of Laminated Safety Glass. Part II:	
The Shuman Machine and Process	28
The Mascart Patent	30
Higher Alcohols as Solvents	31
Non-actinic Safety Glass	32
The Use of a Ray Filter	33
Oil Resin Varnish as a Ray Filter	34
American and Foreign Patents on Safety Glass	35
Technologists Discuss Laminated Glass	35
The Navy and the Glass Industry	36
Editorial:	
The New Aim of Industry—Human Happiness	38
Big Ceramic Week at Chicago—Meetings and Exposition Feb. 4 to 9	39
Moorshead Press and Blow Machine	40
Prof. Turner on Study of Refractories	41
Recent Patents	42
President Authorizes Increased Duties on Plate Glass	44
House Sub-Committee on Glassware Tariff	44
Bright Outlook for Construction Trades This Year	45
Secretary Whiting Outlines Economic Conditions for 1929	46
The Glass World and What It Is Doing:	
Allege Infringement of Laminated Glass Patent	47
Feldspar Producers Consolidate	47
American Window Glass to Increase Fourcault Equipment	47
Duty on Belgian Sand Removed	47
Total 1928 Production of Plate Glass	47
Construction Total for 1928	47
Eisler Again Wins Favorable Patent Decision	48
New York Curb Dealings in Glass Stocks	48
Auto Output Last Year Broke All Records	48
Trade Activities	48
Recent Deaths	49
Coming Meetings	49
What the World Wants	49
Inquiries Received	49
Glass Stock Quotations	49
Current Prices of Glassmaking Materials	50
Monthly Summary of U. S. Foreign Commerce in Glass	50

CLASSIFIED BUYERS' GUIDE, PAGE 20
INDEX TO ADVERTISEMENTS, PAGE 22

The New Aim of Industry—Human Happiness

That rich heritage of the past, the Declaration of Independence acknowledges life, liberty and the pursuit of happiness to be the supreme aims of our lives. Life no longer depends on the caprice of a ruler, as in days gone by. Our laws grant us liberty and thousands have died in the wars of the Revolution, the Civil War and the World War to preserve freedom that we may enjoy it. Our problem to solve now is to obtain happiness. Those who know life realize that happiness can only be found in self-expression. And to most of us self-expression means our daily work. When that can be made a joy we can indeed call ourselves fortunate.

American leaders of industry realize more and more that their task is not confined to earning dividends for their stockholders. Important as this may be, they know that capital can only succeed in a measure as labor is made satisfied with its task. This satisfaction is not only a high wage. It is the part of successful management to create an interest in the work that labor is called upon to do.

Machinery is taking over the monotonous drudgery and the heaviest tasks. Many of us have admired and envied the man handling the steam shovel, the farmer running his tractor, the mechanic directing a complicated piece of machinery. These men find a satisfaction in the employment of their skill that far surpasses the money they earn, whether they themselves realize it or not.

To create a spirit of fellowship between workers is a means to aid men in finding happiness in their work. The value of social clubs, of get-together evenings, the friendly rivalry between departments in athletics, the annual picnic, these things all foster a spirit of cooperation which helps to make the daily task lighter.

There probably will always be dull routine and drudgery, and industry will have to find hands to perform these tasks. But leaders of industry know that to these especially it owes a compensation that can never be expressed in terms of wages alone.

The reward to industry and to capital will be loyalty of its workers, and that community of interest that makes for the one thing we all wish for: happiness and the courage to face whatever fate holds in store for us.

Education

Dr. John Martin Thomas, President of Rutgers College, in an address on "Education," said:

"The expansion of education is based on economic necessity. American business men may just as well make up their minds that education is going to cost the public more rather than less. Manual labor is giving away to machinery and individual operation to large organizations. The result is an increased complexity with demands for a higher degree of education."

"Today no one can be successful in any branch of ceramic industry without application of the principles of chemistry and physics in processes requiring for their direction a high degree of knowledge and skill."

Big Ceramic Week at Chicago

Meetings and Exposition February 4 to 9

As the time draws near for the Annual Meeting of the American Ceramic Society at Hotel Stevens, Chicago, and for the opening of the first American Ceramic Exposition in the Exposition Hall of the hotel on February 4, it becomes evident that the long, hard labor expended by the Chicago Branch of the Society and others working in its interests to make the occasion a notable success are bringing practical results. Early in January considerably more than a hundred of the Exposition booths had been engaged and paid for.

Among the exhibitors who will display finished ceramic products are listed the Cambridge Glass Company, booth 77, Carr-Lowrey Glass Company, booth 62, Fostoria Glass Company, booth 84, Hazel-Atlas Glass Company, booth 95, and the Vitrolite Company, booth 71-72-73.

The programs of the Arts and the Refractories Divisions were given in the January issue.

Organizations meeting in Chicago in conjunction with the exposition are: American Ceramic Society, Canadian National Clay Products Association, American Face Brick Association, Electrical Porcelain Manufacturers' Association, American Refractories Institute, Common Brick Manufacturers' Association of America, Hollow Building Tile Association, National Brick Manufacturers' Association, United States Potters' Association and the Illinois Clay Manufacturers Association.

Revised Program of Glass Division

TUESDAY MORNING SESSION, FEBRUARY 5, 1929

Observations on the Art and Manufacture of Glass in Europe.

9:30 A.M. 1. Introductory Survey. Alexander Silverman, University of Pittsburgh.
10:00 A.M. 2. Artistic Aspects of European Manufacture, Frederick Carder, Corning Glass Works.
10:30 A.M. 3. Color Technique. Henry R. Hellmers.
10:45 A.M. 4. The Bicheroux Plate Glass Process, J. Earle Frazier.
11:00 A.M. 5. Glass House Refractories, C. E. Fulton, Pittsburgh Plate Glass Co.
11:30 A.M. Business Session and Election of Officers.

TUESDAY AFTERNOON SESSION, FEBRUARY 5, 1929

2:00 P.M. 6. The Measurement of the Viscosity of Glass. H. R. Lillie, Corning Glass Works.
2:30 P.M. 7. Radiation Method of Measuring Strain in Glass, L. R. Ingersoll, University of Wisconsin.
3:00 P.M. 8. Dissolved Gases in Glass and their effects on physical properties. A preliminary report. R. C. Darnell, Bureau of Standards.
3:30 P.M. 9. Dimensional Changes in Glass caused by heating cycles. A. Q. Tool, D. B. Lloyd, G. E. Merritt, Bureau of Standards.
4:00 P.M. Discussion of Papers.

WEDNESDAY MORNING SESSION, FEBRUARY 6, 1929

9:30 A.M. 10. Volatility of Selenium and its Compounds in the Manufacture of Selenium Ruby. J. B. Krak, Roessler and Hasslacher Chemical Co.
10:00 A.M. 11. Some Recent Developments in Methods for the Analysis of Glass. G. E. F. Lundell, Bureau of Standards.
10:30 A.M. 12. Devitrification of Glasses. G. W. Morey, Geophysical Laboratory.
11:00 A.M. 13. Density Factors for Soda in Glass. S. R. Scholes, Federal Glass Company.
11:30 A.M. 14. The Effect of Soda, Barium and Zinc on the Elasticity and Thermal Expansion Coefficients of Glass. L. D. Fetterolf, New Jersey Zinc Co.
12:00 A.M. Discussion of Papers.

WEDNESDAY AFTERNOON SESSION, FEBRUARY 6, 1929

2:00 P.M. 15. Temperature Measurements. W. E. Forsythe, Nela Research Laboratory.
3:00 P.M. 16. Corrosion Tests in Glass. G. S. Fulcher, Corning Glass Works.
3:30 P.M. 17. Determination of the Source and the Prevention of Stones in Glass. Herbert Insley, Bureau of Standards.
4:00 P.M. 18. The Phase Equilibrium Diagram for the System ZnO-SiO_2. E. N. Bunting, Bureau of Standards.
4:30 P.M. Discussion of Papers.

Industrial Exhibitors

Among the exhibitions of industrial equipment and supplies of special interest to the glass manufacturing trade, are:

Abrasive Company
Alton Barium Products Co.
American Dressler Tunnel Kilns, Inc.
American Gas Association
Babcock & Wilcox Co.
Banks Spray Equipment Co.
The Bristol Company
The Brown Instrument Co.
The Buckeye Clay Pot Co.
Carborundum Company
Ceramic Color & Chemical Mfg. Co.
Clark Tructractor Co.
Consolidated Feldspar Corp.
Corhart Refractories Co.
The DeVilbiss Company
Dings Magnetic Separator Co.
Erwin Feldspar Co., Inc.
General Electric Co.
Golding Sons Company
A. P. Green Fire Brick Co.
Hinde-Dauch Paper Co.
Johns-Manville Corporation
Leeds and Northrup Co.
Link-Belt Co.
New Castle Refractories Co.
Norton Co.
The Texas Co.
Wilson-Maeulen Co., Inc.

ONE OF THE EXHIBITS

The Babcock & Wilcox Company, New York, will show various types of refractory materials all made from the same kaolinic base. A block of raw clay as mined will be shown and also the several types of burned shapes which are manufactured from this clay. These are of especial interest due to the fact that materials with a very great range of porosity from the same base have been developed.

Another product of lesser density is the B. & W. No. 80 glass tank block. This block averages about 10% porosity and according to the manufacturers has proved itself of great value for lining glass tanks. It is stated that these blocks have been tried out in several tanks melting several kinds of glass, with excellent results. The block exhibited by the company will show the standard finish which is given to all of their blocks in order to true them up. It will show one polished face to indicate the extremely dense and uniform structure. Other products made by this exhibitor will include standard No. 80 fire brick and special shapes and No. 80 light weight fire brick and shapes.

Numerous attractions including an extensive radio program will be provided to draw visitors to the show and means taken to implant in their minds an adequate appreciation of ceramic arts and products—particularly those of American origin.

Woman is the greatest inspiration behind the American manufacturer today, driving him to new ideas, new ideals; compelling him to put color, art and beauty in his products and speeding up his mental activities. This statement was made by Ross C. Purdy, Secretary of the American Ceramic Society in telling of plans for holding the first American Ceramic Exposition ever attempted.

"Every step in modernizing and beautifying the American home has been brought about by the desires and demands of women," he said. "We are now entering the greatest age of color and beauty in the home that the world has ever witnessed. I mean by that not the homes of the few but the homes of the millions.

"Because woman, in the last five years, has demanded color in her china—ivory and colorful designs to replace the old monotonous white—we, the manufacturers, have given these things to her. Because she has voiced her desire for delicate tints in glassware to blend with her more colorful china, rugs, linens and other decorations, we have given her that also.

"Because she wants colorful tiles for her bath, colorful art pottery for her living room, colorful roof tiles—even gayer building brick, we have given her all these too. Woman has awakened to the fact that it costs very little more to live brightly, among cheerful and happy surroundings, than to pass a life in drabness and dullness.

"Talk to any large manufacturer who makes products for the home, or any successful merchant and see if he agrees with me."

Accordingly the American Ceramic Exposition will display the most remarkable, colorful and modern exhibition of ceramic wares ever gathered in one place in the United States. More than $250,000 worth of finest glass, china, pottery, art ware, stoneware, tile, etc., all made-in-America, will be assembled in one great room.

Moorshead Press and Blow Machine

Now in Wide Mouth Container Production in England

It may be taken as a generally accepted fact by bottle makers that the press and blow method has certain very definite advantages over other processes for the production of hollow glass containers.

This process can, of course, only be employed in the making of wide or semi-wide mouth ware, there being certain limitations which are fixed by the ratio that the weight of the article and its general proportions bear to the width of the mouth or opening.

In addition to this, it has also been the practice heretofore in the design of machines employing this method, to use solid blank molds, because of the high hydrostatic pressures which are exerted on the blank mold when the pressing operation takes place, and obviously where a solid blank mold is employed the parison can only be removed by lifting it out, thereby necessitating a straight taper in the blank, which fact also places further limitations on the character of ware which can be made with this process.

In the Moorshead machine, which is continuous in operation, split or divided blank molds are employed, making it possible to use a shouldered parison, and also split neck rings are employed, so that any bottle that can be made on any other type of machine, can, so long as the ratios hereinbefore mentioned between the width of the opening and the weight or proportions of the glass are within the necessary limits, be made on this machine which, it will be quite readily appreciated, very greatly increases its range over other types of press and blow machines now in use. Being continuous in operation and employing a separate plunger for each head, very high speeds are also made possible, and in actual practice greater speeds in bottles per minute, its inventor states, have been obtained, making the same class of ware on an 8-mold machine, than have been possible on a 10-arm A. R. type Owens machine.

In no other method can so uniform a skin be formed on the parison, not only upon the outside, but also on the inside. This is due to the action of the plunger, which not only presses the glass into intimate contact with the wall of the blank mold under

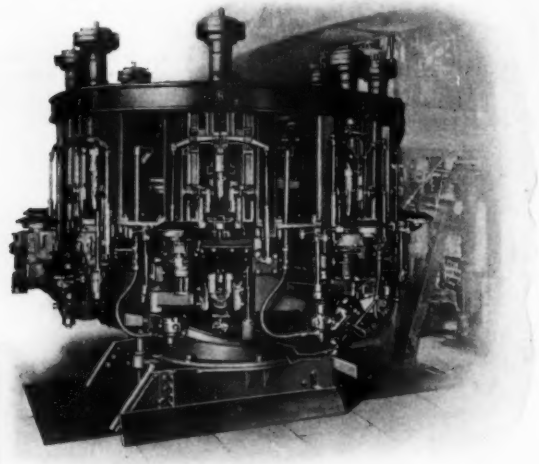


FIG. 1—NEW EIGHT-MOLD PRESS AND BLOW MACHINE

any pressure that is desirable, but forms under identical pressure, a counterpart of this skin on the inside of the parison, also resulting in an extremely even distribution of glass in the finished bottle. In no other system, it is asserted, can the heavy finishes encountered in most wide mouth ware be set so effectively without producing checks, at such commercially advantageous rates of production.

The general adoption hitherto of a single pressing plunger, entailing a machine working on the intermittent principle, has made high speeds difficult for mechanical rather than actual operating considerations.

With the consequent delay that must occur between gathering the glass and pressing the finish on an intermittent machine, pressing pressures required to form the finish in glass which has already commenced to chill, have been necessarily very high. This has called for extremely massive blank molds and supporting members, the acceleration and deceleration of all of which each time a bottle is made, constitutes on a multi-head machine at

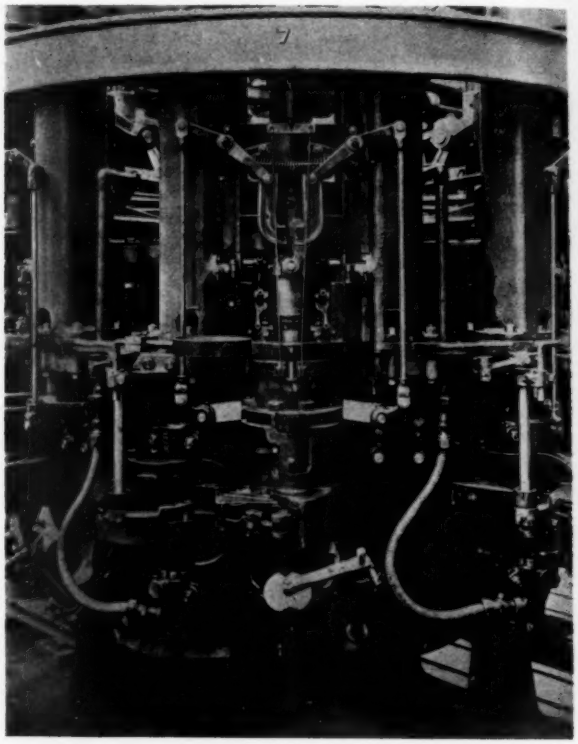


FIG. 2—FRONT VIEW OF HEAD, SHOWING PLUNGER DOWN

high speeds, a mechanical problem so difficult of satisfactory solution as to have more or less limited the adoption of the system itself.

In adopting the principle of continuous revolution, the inventor of the present machine has not only avoided the practical difficulties encountered by previous designers in this field in regard to the problems associated with rapid acceleration of masses, but has made possible the adoption of other features that almost equally contribute to the success of this new machine.

The possibility afforded of pressing the finish immediately after the glass has been gathered reduces the plunger pressures necessary to a fraction of what has always been held previously to be required. This in itself is of obvious advantage. But with such reduced plunger pressures the adoption of a blank mold made in halves becomes a practical possibility, and so permits of a shouldered parison being adopted where desirable.

Description of Operation

In describing the action of the machine in making a bottle, that of only one "head" or unit will be referred to, since the action of all heads is identical.

In the course of revolution in the machine, an open blank mold traveling around in its outer position approaches the feeder or pour-out point. Just before reaching it the blank mold is closed and immediately after receives a charge of glass as it passes beneath the orifice in the feeder.

The blank mold is now swung horizontally inward upon its arm, until it aligns with the axis of the presser plunger.

The register head and neck mold which are in their up position, now descend, the spigot on the neck mold entering the recess in the blank mold, to ensure accurate register, and pressing finish ring, neck ring and blank mold together to ensure tight joints between them.

At the same time the pressing plunger hitherto in its up position, starts to descend also.

The first effect of this is to cause the locking dogs to swing down to engage the blank scissor arms and lock the two halves of the blank mold securely together.

The plunger passing through the finish and neck rings now enters the glass within the blank mold and displaces a part of it,

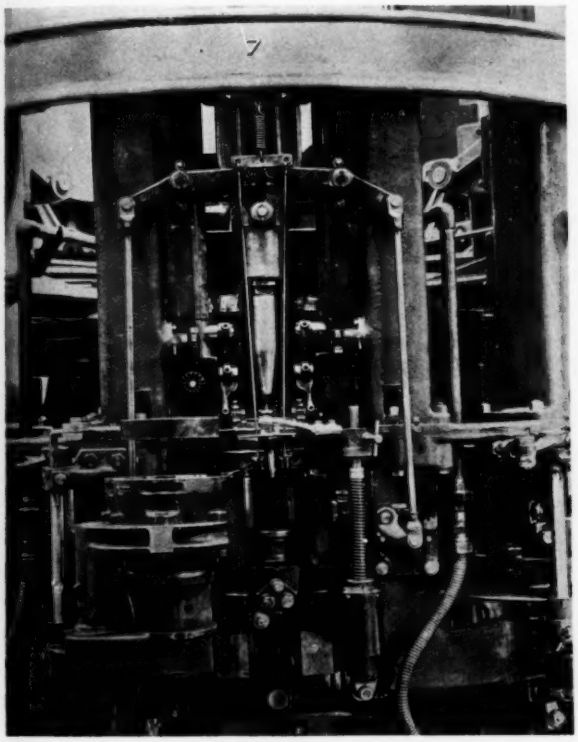


FIG. 3—FRONT VIEW OF HEAD, SHOWING PLUNGER UP

which, as a result of the pressure upon it flows up around the plunger into the neck and finish rings, completely filling them, and thus forming the finish of the bottle.

After remaining in the glass for a brief period, varying with the class of ware, during which the finish sets solid, the plunger is withdrawn and raised to its "up" position, this movement raising the locking dogs seen in Fig. 3, and leaving the blank mold free to be opened.

The register head and neck ring are now raised very slightly so as to free the blank mold from the downward pressure of the neck mold, and the blank mold is immediately opened and then swung outward upon its arm.

The parison is now left hanging suspended from the neck ring by its "finish." The register head again descends to its "down" position and the open finish mold is now raised from its "down" position until it is in contact with the under side of the neck mold. The finish mold then closes around the parison, the two halves engaging the registering pins projecting from the register head so as to correctly align finish mold and neck mold.

The blow slide valve, hitherto withdrawn to permit of the descent of the plunger, now moves forward to cover the central bore of the register head, and so connect it with the blowing air port.

The blowing of the bottle then commences, being either early or late according to the requirements of the ware being made, the adjustment of the blowing air valve cam controlling this, and the duration of blow. Upon completion of blow, the blowing slide valve is withdrawn.

The neck mold is now opened, and with the register head raised to the "up" position. This frees the finish and neck of the bottle, and the finish mold still closed and containing the blown bottle, is lowered to its "down" or inoperative position.

The bottle continues around in the mold for approximately another ninety degrees of revolution, when, upon reaching the delivery point, the presser foot is brought down upon the finish of the bottle, so as to hold it, and the finish mold is opened. The presser foot then rises off the bottle, which being inclined outward, immediately pitches forward on to the table or conveyor provided to receive the finished bottles.

A wide range of adjustments is provided on the machine, so that the most delicate treatment can be given to the blowing of the bottle, which fact, in addition to the instantaneous pressing operation heretofore described, has made it possible to obtain speeds in the manufacture of wide mouth bottles heretofore thought impossible.

The machine here illustrated has been running for the last six weeks of the past year (at one of the plants of The United Glass Bottle Manufacturers, Ltd., of London, England, where it was developed by T. C. Moorshead, Technical Director and General Manager of the Company) on a two-pound jam jar of 25½ ounce liquid capacity, weight 16⅛ ounce, with an average daily production (good or packed ware) of 260 gross per day, which may be considered very good for an 8-mold machine, and it is at the present time making a 4 pound confectionery jar, 44 ounce weight, liquid capacity 80/84 ounce, at a rate of 17 per minute.

The maximum possible speed of this machine is 52 bottles per minute, but as the machine was made primarily for medium size and large ware, and not intended for making small ware, it will be agreed that this is a very high speed for a heavy machine of this type with only eight heads.

The machine can be built with any number of heads and of lighter construction for light ware and higher speeds.

Prof. Turner on Study of Refractories

At a meeting of the Society of Glass Technology at Stourbridge, England, Prof. W. E. S. Turner spoke on "Recent Progress in the Study of Refractory Materials." He referred at the outset to the work of the Refractories Committee of the Society of Glass Technology and to the general report (drawn up by Mr. W. J. Rees the Chairman of the Committee) which had recently been published. Prof. Turner went on to state some of the most important problems awaiting solution; and referred at some length to work which had been done by the German Society of Glass Technology.

The results of the two independent sets of investigation showed a good deal of concordance. Particulars were given of a number of British and German clays of various compositions and types. Clays rich in alumina were more resistant to the action of a lead batch than were clays with a lower alumina but a higher silica content. Similar results were obtained with soda-lime-silica, and with opal glass batches. Clays with high ferric oxide content were less resistant to corrosion than those with low ferric oxide values. Sodium sulphate was the one raw material to which highly siliceous clays were more resistant than the highly aluminous clays. Emphasis was laid upon the greater importance of porosity on the properties and behavior of the glass. Clays with high porosity were most susceptible to attack. High temperature firing of refractory materials for the glasshouse was most important. Clays with high alumina content were better for nearly all purposes than were clays of low alumina content, provided the clays were given adequate firing.

Professor Turner also referred to investigations on the tensile strength and expansion of glasshouse refractories by Mr. J. F. Hyslop and his colleagues at the Research Laboratories of the General Electric Co., Ltd., at Wembley.

Recent Patents

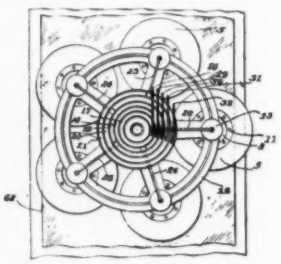
NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

APPARATUS FOR CONVEYING THE WORKHOLDING TABLES OF A CONTINUOUSLY-MOVING SERIES OF TABLES. U. S. 1,693,534. Nov. 27, 1928. Frederic Barnes Waldron, Prescot, England, assignor to Pilkington Brothers, Ltd. Filed 8/11/24, and in Great Britain 11/23/23. A table, on reaching the finishing end of the apparatus, is pushed on to an elevator so as to be free of the following tables and the elevator is then lowered so as to bring the table on to a runway situated below the level of the continuously moving series of tables. The table is transported on this runway to the starting end of the apparatus and it is there lifted by an elevator to the level at which the work is executed and then pushed so as to come into contact with the next preceding table and engage with the driving gear of the apparatus.

SHEET-GLASS-FORMING APPARATUS AND METHOD. U. S. 1,697,227. Edward Danner, Detroit, Mich. Filed 2/10/21. An object is the provision of a furnace construction whereby the glass stream flowing through the tempering chamber is surrounded by a heating space to maintain the side walls at a predetermined temperature and thereby prevent cooling of the side edges of the stream by reason of its contact with the chamber walls. A further object of the invention is the provision of certain improvements in the apparatus for vertically drawing or flowing glass in sheet form down opposite sides of a slab or directing member disclosed in Fig. 12 of patent No. 1,261,367, and in some of the forms contained in patent No. 1,555,358 issued September 29, 1925.

APPARATUS FOR POLISHING PLATE GLASS. U. S. 1,698,365. Jan. 8, 1929. Halbert K. Hitchcock, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. Filed 10/29/23. In combination in polishing apparatus, a runner frame having on its upper side a plurality of concentric annular troughs, a plurality of runner blocks carried by the frame and each provided with a facing of yielding material, a conduit extending down to each of said troughs for supplying a polishing mixture thereto, means for supplying a polishing mixture, a rotating device in said container provided with a plurality of buckets arranged in series which one after the other dip up a portion of the mixture and discharge it to one of said conduits, and conduits leading from said troughs to a position of discharge adjacent the runner blocks.

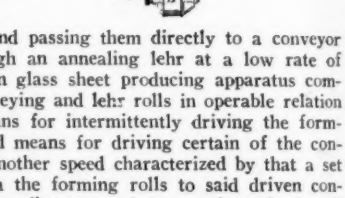


SHEET-GLASS APPARATUS. U. S. 1,698,492. Jan. 8, 1929. John L. Drake, Toledo, O., assignor to The Libbey-Owens Sheet Glass Company. Filed 10/19/25. In sheet glass apparatus, including a mass of molten glass, means for drawing a sheet therefrom, a heat-absorbing means for protecting the sheet from heat around the molten glass from which the sheet is drawn, said heat-absorbing means being shaped to expose the central portion of the molten glass to more of the atmosphere than the remainder of the flow.

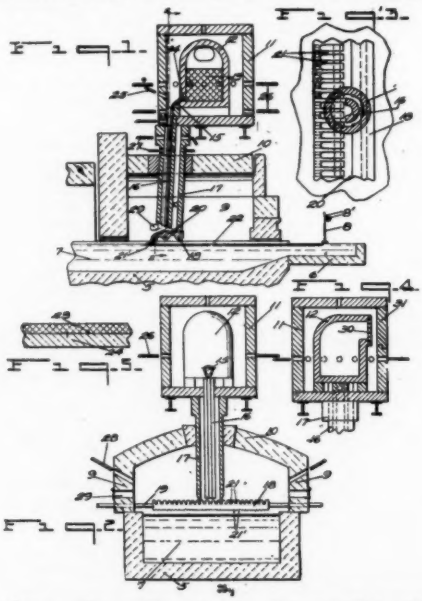
METHOD AND APPARATUS FOR SURFACING PLATE GLASS. U. S. 1,686,742. Oct. 9, 1928. John H. Fox, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. Filed 7/21/27. Two sets of cars or tables adapted to form a continuous train and carry on their upper surfaces the sheets of glass to be surfaced.

DRAWING SHEET GLASS. U. S. 1,697,104. January 1, 1929. Clarence P. Byrnes, Sewickley, Pa. Filed 6/8/21. An apparatus for the continuous drawing of sheet glass over a bending roll, a bending roll system arranged to contact with the thickened edge portion only of the sheet, and skewed rollers adjacent the bending roll system the skewed and tension rolls being arranged to impart side strains to the sheet in the region of the bending roll system, substantially as described.

METHOD AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,697,504. Jan. 1, 1929. Richard D. Humphreys, Mount Kisco, N. Y., assignor to Mississippi Glass Company. Filed 3/20/25. Apparatus adapted for forming sheet glass in a continuous stream and by which the glass is carried through an annealing lehr at the same rate of speed as that at which it is formed, or for forming single sheets at a high rate of speed and passing them directly to a conveyor which carries them through an annealing lehr at a low rate of speed. The combination in glass sheet producing apparatus comprising forming rolls, conveying and lehr rolls in operable relation to said forming rolls, means for intermittently driving the forming rolls at one speed, and means for driving certain of the conveying and lehr rolls at another speed characterized by that a set of idler rolls extend from the forming rolls to said driven conveying and lehr rolls for a distance at least equal to the length of the glass sheet being formed.



METHOD AND APPARATUS FOR PRODUCING COLORED GLASS. U. S. 1,698,491. Jan. 8, 1929. Edgar J. Brasseur and William R. Geddes, Charleston, W. Va., assignors to The Libbey-Owens Sheet Glass Company. Filed 3/25/27. Apparatus for producing colored glass including means for flowing the colored glass upon the surface of a moving body of plain glass and then drawing this glass in sheet form. The cooling chamber 5 is supplied with ordinary more or less colorless molten glass 7 from the melting end of the furnace and this glass flows into the drawpot 6 and is adapted



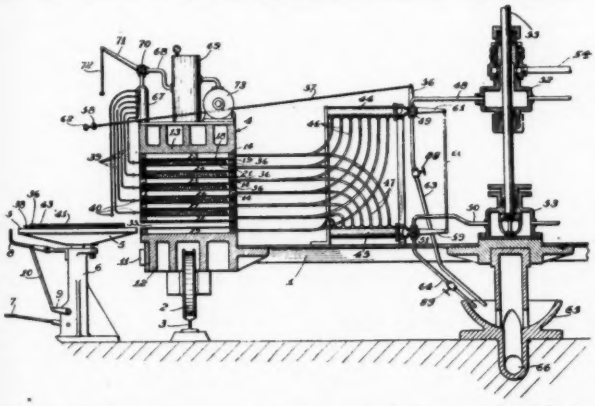
to be drawn away in sheet form as indicated at 8 by suitable drawing means 8'. Supported above the cooling chamber 5 is a housing 11 within which is arranged the flash pot 12 adapted to contain the colored glass or flashing 13. The chute 16 is positioned in direct alignment with the flow lip 15 and is adapted to receive the colored glass or flashing flowing thereover from the pot 12. Arranged beneath the chute 16 is a distributing member 18 supported upon rods 19 which extend outwardly through openings in the side walls 9 of the cooling chamber 5. This distributing member 18 extends transversely over the molten glass 7 and is formed in its upper surface with a longitudinally extending supply channel 20 from which extend a plurality of spaced lateral feed channels 21. The bottom of the member 18 is provided at the outer ends of the feed channels 21 with teeth 21. The distributing member 18 is so constructed as to maintain an even flow of flashing over the full width of the molten glass 7. That is to say, the flashing will drip from the points of the teeth 21' and thus be evenly distributed.

Were these teeth not provided, the colored glass would be liable to run to one end or the other of the distributing member if not absolutely horizontal.

The flashing forms a thin layer of colored glass 22 upon the surface of the plain or colorless body of glass 7 and flows along with this glass into the draw-pot 6 from which it is drawn away in the sheet indicated at 8.

APPARATUS FOR MAKING COMPOSITE GLASS. U. S. 1,698,371. Jan. 8, 1929. William Orland Lytle, New Kensington, Pa., assignor to Pittsburgh Plate Glass Company. Filed 3/10/27. Apparatus for making composite glass, and particularly to the means for applying heat and pressure to cause the joinder between the glass and the reinforcing sheet used therebetween, such sheet ordinarily being of celluloid. It is preferred to assemble the sheets with a coating of cement, such as gelatin, dried upon the surfaces of the glass sheets. A modification of the apparatus described in the pending application, Serial No. 164,511, designed to provide an apparatus, which may be more easily and quickly loaded than the form of apparatus heretofore proposed employing diaphragms and rubber bags.

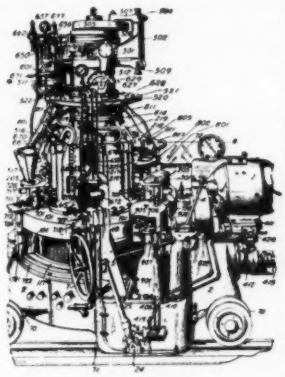
The turntable carries a series of cabinets 4, only one of which is shown. A loading table 5, may be moved up and down by any desired means. By operating the pedal the table may be carried upward step by step past the series of compartments in a cabinet. As each cabinet is brought opposite the table, its compartments



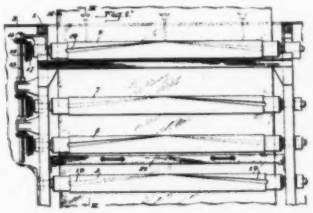
are loaded with trays carrying the sets of sheets to be joined together. The table also serves for unloading the cabinets. The cabinet is provided with the series of pressure chambers 23 to 29, such chambers in each case having a relatively stiff rigid top plate of metal and a flexible bottom plate or diaphragm of rubber, with the frame members 14 acting as the side walls of the chambers. A slot or compartment is also thus provided beneath each rubber diaphragm, and it is in these slots or recesses that the sets of plates to be joined together are placed for the pressing operation.

Mounted on the turn table opposite each of the cabinets 13 is a hot water supply header 44 and a cold water supply header 45. The compartments 23 to 29 are connected to the hot and cold water headers by the flexible pipes 46, 47, etc. One or two operators only are required to keep the apparatus operating at capacity. The suction apparatus is also operated while pressure is being applied to the plates, this being accomplished by opening the valve 70 to exhaust the air from the spaces carrying the composite plates. This facilitates the removal of any air which is trapped between the glass plates and the celluloid.

GLASS-BLOWING MACHINE. U. S. 1,693,843. Dec. 4, 1928. Max Jaeger, Long Island City, N. Y., assignor to Anchor Cap & Closure Corp. Filed 8/6/24. A glass machine comprising a rotatable mold table, a split blow mold, a blow head for said blow mold movable with respect to said solid ring mold, a solid ring mold having a depending portion of substantial length adapted to telescope about the outer wall of the article thereby to provide a smooth sealing zone at the upper end. This comprises a continuously rotating mold table having a constant speed of rotation, except when the speed is changed for adjustments, and wherein the feeding, pressing, blowing, and delivering operations are all performed without in any way changing the speed of rotation of the machine. The load is very even, shock and jars are largely eliminated. Where automatic feeders have been used it has been the practice to drive the feeder independently of the press. This has made it necessary to coordinate two separately driven machines to secure a common timing for the interval when the glass is delivered from the feeder to the press. The press molds rise through the mold table between the members of the split blow-molds and receive the glass charge which is dropped from the feeder into a funnel that at the feeding moment is moving clockwise with the mold.



APPARATUS FOR DRAWING GLASS. U. S. 1,698,378. Jan. 8, 1929. John A. Sweet, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. Filed 12/14/27. The invention involves an expedient for getting rid of the chips which fall down between the rolls in the Fourcault process of drawing glass, this being accomplished by providing grooves longitudinally in the surfaces of the rolls, into which the chips fall, and are carried by the rotation of the rolls to the rear sides thereof, where they are dumped by gravity into suitable receptacles placed below the level of the rolls. These grooves preferably extend circumferentially of the rolls, as well as longitudinally thereof, in order not to impair the continuity of the roll surface and thus interfere with its gripping effect.



GLASS-WORKING APPARATUS. U. S. 1,692,858. Nov. 27, 1928. Karl E. Peiler, West Hartford, Conn., assignor to Hartford-Empire Company. Filed 12/7/26. Vertically adjustable shearing mechanism for suction feeding cups and for the suction molds of multiple-mold machines of the Owens type, so that the quantity of glass in the cups or in the molds may be varied at will. By the independent vertical adjustment of this shearing mechanism, uniform amounts of molten glass may be separated from the gathering pool for all the cups or molds, irrespective of any irregularities therein which may cause variations of the cubic contents thereof; or, if desired, unequal quantities of molten glass may be accurately collected in the several cups or molds to form ware of different weights on the same machine. The method of obtaining a series of mold charges of molten glass of equal weight collected by a plurality of suction fed receptacles having cavities of unequal cubic capacity, which comprises successively presenting the receptacles to the surface of a glass supply, drawing charges of glass into said receptacles and serving the glass gathered in the successive receptacles from the glass of the supply in planes spaced from and below the receptacles, said spacing being selected and differing in accordance with the cubic capacity of receptacles.

President Authorizes Increased Duties on Plate Glass

Adds from three and one-half to four and one-half cents per square foot

Rates of Duty on Cast Polished Plate Glass

UNDER TARIFF ACT OF 1922 now superceded by increased rates.
12½ cents per sq. ft. on sizes not exceeding 384 sq. in.
15 cents per sq. ft. on sizes above 384 sq. in. and not exceeding 720 sq. in.
17½ cents per sq. ft. on sizes above 720 sq. in.

UNDER PRESIDENT COOLIDGE'S AUTHORITY the rates have been increased to the following, effective 30 days from January 17, 1929:
16 cents per sq. ft. on sizes not exceeding 384 sq. in.
19 cents per sq. ft. on sizes above 384 sq. in. and not exceeding 720 sq. in.
22 cents per sq. ft. on sizes above 720 sq. in.

Increases in customs duties on cast polished plate glass are provided for in a proclamation issued January 17, 1929, by President Coolidge under the flexible provisions of the Tariff Act of 1922. A brief summary of the changes appeared in the January 18 issue of the *U. S. Daily*. On the following day, January 19, the full text of the statement issued from the White House was given.

The full text of the White House statement follows:

The President, under authority conferred upon him by section 315 of the Tariff Act of 1922, has issued a proclamation, effective 30 days from date, changing the rates of duty on cast polished plate glass from 12½ cents per square foot to 16 cents per square foot on sizes not exceeding 384 square inches; from 15 cents per square foot to 19 cents per square foot on sizes above 384 square inches and not exceeding 720 square inches; and from 17½ cents per square foot to 22 cents per square foot on sizes above 720 square inches.

Production Costs Investigated.

In order to assist the President in determining differences in cost of producing domestic and foreign cast polished plate glass, the Tariff Commission conducted cost investigations in the United States and in Belgium, the principal competing country.

The rates of duty in the Tariff Act of 1922 on cast polished plate glass were as follows: 12½ cents per square foot on sizes not exceeding 384 square inches, 15 cents per square foot on sizes above 384 square inches and not exceeding 720 square inches and 17½ cents on sizes above 720 square inches.

Domestic production of plate glass in 1927 was 111,390,933 square feet, of which approximately 1,000,000 square feet were exported. European production amounts to slightly over 100,000,000 square feet annually. Belgium alone produces from 35,000,000 to 40,000,000 square feet, of which approximately one-fourth is exported to the United States.

American Industry in Lead

The rapid rise to world leadership of the American plate-glass industry, which was virtually non-existent 40 years ago, may be attributed largely to building expansion and the growth of the automobile industry. The demand in the fall of 1922 and during 1923 for plate glass occasioned by the vogue of the closed car and the unusual building operations throughout the country exceeded by far the capacity of American plants.

Imports, which previously had never exceeded 3,000,000 square feet per year, amounted in 1922 to over 10,000,000 square feet and in 1923 to over 25,000,000 square feet, or equivalent to approximately 30 per cent of the domestic production for the latter year.

However, in spite of increased importations and a maximum output of domestic factories, the available supply was not sufficient to meet the needs of the country. Prices rose to new levels and plate glass entered a sellers' market commanding premium prices for prompt delivery regardless of source.

Following this period of industrial activity there was a general movement towards expansion throughout the plate-glass industry; old plants were enlarged and new ones built in an effort to keep pace with this increasing demand. In both the United States and Belgium new and improved methods of manufacturing have been developed on the principle of large-scale output of a more or less standard product.

Some of the large automobile manufacturers, in order to secure an adequate supply of plate glass, either have obtained control of existing plate-glass plants or have built new ones in which new methods of manufacturing have been applied.

In the United States these somewhat revolutionary developments in the plate-glass industry resulted in the creation of a supply evidently greater than the demand during the next two years, 1924 and 1925, warranted. Imports decreased from 25,000,000 square feet in 1923 to approximately 16,000,000 square feet for both the years 1924 and 1925, and prices of both domestic and foreign glass were reduced about 15 per cent.

In 1926, however, there was a return of something like the conditions of supply and demand obtaining in 1923, and imports again amounted to nearly 25,000,000 square feet. Domestic production was larger in 1926 than in any previous year, amounting to over 128,000,000 square feet.

In 1927 a decrease in domestic production to 111,000,000 square feet and in imports to approximately 15,000,000 square feet was attributed to the curtailment of production of certain automobiles.

House Sub-Committee on Glassware Tariff

The meetings announced in December, of the Sub-Committee of the House of Representatives Committee on Ways and Means to consider schedule 2, which includes glassware, were held on January 10 and 11 and were attended by numerous representatives of the glass industry. Some of the testimony offered, reported briefly in the *U. S. Daily, New York Times* and other journals, follows:

H. O. Brawner of Swindell Brothers and member of the Glass Container Association opened the discussion. W. R. Leach of Carr-Lowrey Glass Company recommended that the ad volorem rates on glass containers be increased from 55 to 82½ per cent and that there be inserted in paragraph 217 a provision excluding perfume and toilet water bottles and jars from the operation of that paragraph. This provision is desired in order that no administrative or judicial interpretation can include these items in paragraph 217 and that they may be definitely and specifically included under the ad valorem duties in paragraph 218 at rates not less than 82½ per cent. There was no intent on the part of Congress when the law was passed, or of glass manufacturers, to exclude "glass bottles" and "decanters," as is evidenced by the fact that custom duties have been collected at the rate of 55 per cent ad valorem since the act of 1923 became a law. John M. Gayner of the Gayner Glass Company, The T. C. Wheaton Company, Millville, N. J. and the Chicago Heights Bottle Company, all manufacturers of perfume and toilet water bottles and jars joined in presenting the brief.

James Maloney of the Glass Blowers' Association also urged higher duties on hand-blown bottles and other containers. He stated that the use of automatic machinery had cut down the number of hand-workers to between 1,500 and 2,000 as compared with 12,000 to 13,000 workmen employed in 1905 when the automatic machines were adopted. Thomas W. McCreary of the Illuminating Glassware Guild and Representative Chalmers of Ohio representing the Libbey Glass Manufacturing Company of Toledo, makers of gauge glass, asked for the highest tariff rating possible because this glass is used by the Navy. Chester G. Fisher, Pittsburgh, representing scientific apparatus makers and Ralph Barber of the Vineland Flint Glass Company said that scientific glass should have increased tariff protection up to 85 per cent.

Joseph M. Gillooly of the American Flint Glass Workers' Union said that he spoke for 60,000 workers and asked that American valuations be applied to imported chemical glass products, eighty per cent of the Czechoslovakian production of which is being exported to the United States free of duty. Wages in that country are equal to $10 a week, he said, compared with $35 a week in the United States. S. S. Dickinson of the Becton-Dickinson Company testified that to protect the manufacture of hypodermic syringes an increase of duty up to 225 or 250 per cent would be necessary. He told of an imported hypodermic syringe that clears the New York Custom House at a cost of 21 cents, delivered there, compared with the cost of 56¼ cents for manufacturing it in this country.

Ravenna mosaics should be treated as works of art and not taxed, according to Gerdt A. Wagner of New York.

E. J. Barry of Toledo, representing the National Association of Manufacturers of Pressed and Blown Glassware, urged American valuations as the basis of levying duties on imported glassware and especially increased duties on table glassware to offset advancing importations.

On January 12, manufacturers of stained glass windows urged before the sub-committee, that duties on imported products of that character be increased. George L. Payne of Patterson, N. J., representing the Stained Glass Association of America declared that heavy protection is necessary if the industry is to continue competing with imported products made by cheap European labor. He requested that the rate of duty be increased to $5 per square foot and 100 per cent ad valorem on all stained glass windows valued at $15 or less per square foot. He asserted that labor costs amounted to 70 per cent of the total cost and that in Germany such workers received 43 cents per hour, in England 75 cents and in America $1.25 per hour. Fred T. Ottinger of St. Louis stated that a stained glass window that could be imported now at a cost of $190 could be sold in the United States for $600, while a window costing $206 to import could be sold for $900.

William L. Monro, president of the American Window Glass Company representing the Window Glass Manufacturers' Association which covers about 95 per cent of the total annual production in this country asked for an average increase of 46.1 per cent duties on various sizes of window glass. He was opposed by Judge John W. Price, representing Benjamin Schottland and the Vitrea Company, Inc., importers of New York, who urged a 50 per cent reduction of existing tariff duties on window glass. He stated that the present rates are prohibitive on importations as far as shipping to the interior of the country is concerned. C. J. Gundlach of the Mississippi Glass Company, New York, representing the Rolled Glass Manufacturers of the United States asked for additional duties on rolled plate glass ranging from 2½ to 5 cents per square foot. A. Solomon, New York, chairman of the Association of Imported Plate Glass Consumers asked for a reduction of plate glass duties. H. B. Higgins of the Pittsburgh Plate Glass Company suggested a combination of specific and ad valorem rates on plate glass used in automobiles, the specific to be 20 cents a pound and the ad valorem rate 25 per cent. Mr. Higgins was asked whether the tariff has contributed principally to the profits made by his company and replied that it certainly had not. He stated that his company produced about 50 per cent of the domestic output of plate glass entering the competitive market. Mr. Higgins was asked by Representative Garner of Texas to send a statement of the profits of the Pittsburgh Glass Company, and consented to do so. Richard B. Tucker, New York, representing the American Plate Glass Corporation, spoke of the foreign combinations controlling the selling of glass exported from Europe as giving the manufacturers there a great advantage over American firms. Paul Potter of Potter Bros., Brooklyn, asked for protection on ballotini, a glass product used for decorating women's wear, marketed by his firm since 1921. He said the price then of 70 cents per pound had now been reduced to 24 cents to meet foreign competition.

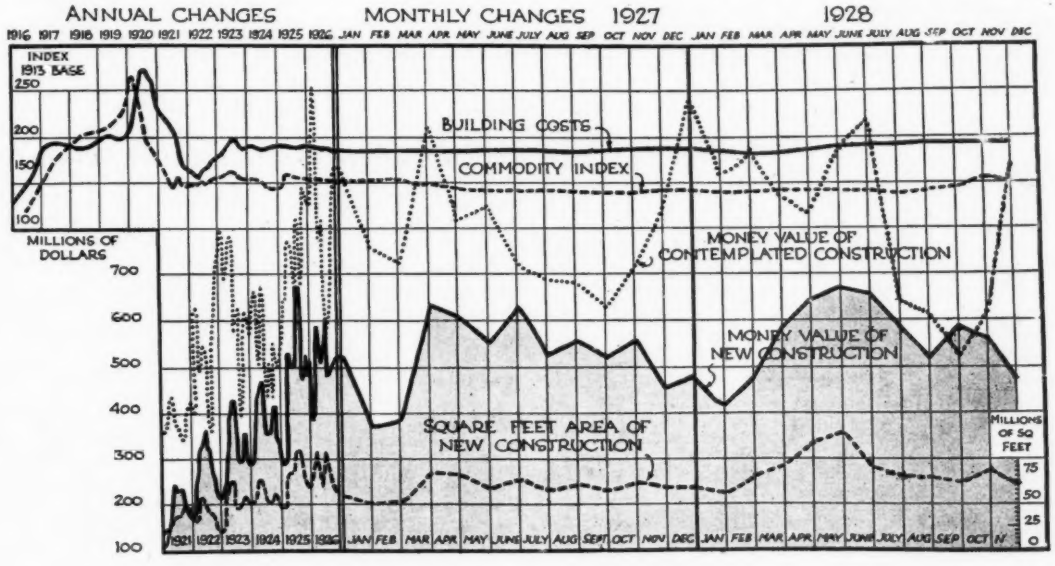
Wm. L. Munro of Pittsburgh stated that his company was forced to cut the price of safety glass about 25 per cent in November, 1927. He stated that as prices subsequently were raised in this country imports again increased.

The hearings on glass were completed on January 12.

Bright Outlook for Construction Trades This Year

The Architectural Forum's Annual Forecast

The annual forecast of building construction, conducted by the Architectural Forum, for the past several years has consistently predicted within very reasonable limits the volume of building and other construction business expected to be contracted for during the ensuing year. As a result of the detailed and exhaustive survey of potential building activity in 1929 by this organization their report states that the present year is likely to excel all past records. The report for this year was prepared with better facilities than ever before for ascertaining the actual conditions in the construction industries. The forecast is based upon confidential individual reports from the offices of 2,057 architects throughout the country covering in detail the work now on their boards or in definite contemplation for contract-letting in 1929, plus information derived from other sources. The actual contract record of 1928, according to the F. W. Dodge Corporation, was approximately 5% ahead of the total for the year 1927 and 4% in excess of the total for 1926.



THE BUILDING SITUATION

The various index lines are designated on the chart, which is developed from reports of the United States Department of Commerce, the F. W. Dodge Corporation, and the *Engineering News-Record*

© NATIONAL BUILDING PUBLICATIONS, INC., NEW YORK

Building Activity in the United States Since 1916

These figures include not only building construction but also engineering work and a considerable part of the volume reported is to be found in the public works and utilities classification. On the other hand, the actual building construction has continued in such a volume for five years now that it seems absolutely necessary to discard the "boom period" and to accept the new normal.

Significant changes in building trends are pointed out in the Forum's report. While every condition points to a continuation year. The outflow of gold which began in the autumn of 1927 continued during the first half of 1928 and caused a reversal in the easy money situation that had prevailed for several years. Public attention has been fixed on the rise in the rates on stock-exchange 90-day time loans from 4¼ per cent in January to 7½ per cent in the early autumn and the even greater rise in call money rates. It is well, however, to note that bank credit for commercial purposes has been in ample supply at rates ranging

BUILDING TYPES	N. EASTERN STATES	N. ATLANTIC STATES	S. EASTERN STATES	S. WESTERN STATES	MIDDLE STATES	WESTERN STATES	U. S. A.
Automotive	$14,469,400	$42,132,200	$7,447,000	$10,670,000	$56,322,200	$14,539,800	$145,580,600
Banks	15,730,000	53,312,600	1,148,400	5,984,000	56,999,800	12,859,000	146,033,800
Apartments	16,801,400	366,163,600	10,469,800	20,882,400	171,941,000	84,992,600	671,250,800
Apartment Hotels	2,640,000	83,560,400	4,972,000	15,554,000	97,979,200	41,925,400	246,631,000
Club, Fraternal, etc.	7,231,400	70,010,600	1,515,800	13,191,200	66,704,000	15,987,400	174,640,400
Community and Memorial	3,421,000	21,232,200	1,529,000	5,711,200	17,047,800	11,710,600	60,651,800
Churches	21,142,000	55,105,600	22,770,000	23,859,000	69,885,200	20,409,400	213,171,200
Dwellings (Below $20,000)	10,936,200	83,540,600	6,791,400	11,215,600	40,198,400	24,314,400	176,996,600
Dwellings ($20,000 to $50,000)	10,346,600	38,445,000	5,935,600	7,629,600	37,470,400	15,085,400	114,912,600
Dwellings (Over $50,000)	6,749,600	43,443,400	5,555,000	5,662,800	25,348,400	12,837,000	99,596,200
Hotels	21,659,000	95,763,800	14,212,000	45,513,600	101,378,200	66,149,600	344,676,200
Hospitals	18,860,600	110,105,600	4,606,800	12,749,000	73,035,600	33,169,400	252,527,000
Industrial	20,295,000	130,191,600	15,661,800	35,846,800	154,671,000	28,789,200	385,455,400
Office Buildings	12,485,000	244,101,000	4,859,800	41,296,200	300,979,800	87,760,200	691,482,000
Public Buildings	15,518,800	185,924,200	6,226,000	18,499,800	87,353,200	27,689,200	341,211,200
Schools	44,811,800	165,499,400	13,010,800	60,152,400	256,326,400	57,981,000	597,781,800
Stores	6,366,800	78,876,600	4,477,000	7,926,600	55,497,200	23,324,400	176,468,600
Theaters (All Types)	6,303,000	62,891,400	3,746,600	7,812,200	74,032,200	8,773,600	163,559,000
Welfare Y. M. C. A., etc.	10,799,800	48,100,800	5,077,600	13,666,400	31,858,200	4,644,200	114,147,000
TOTAL VALUE OF NEW BUILDINGS	$266,567,400	$1,978,400,600	$140,012,400	$363,822,800	$1,775,028,200	$592,941,800	$5,116,773,200

New Construction Under Architect's Supervision..... $5,116,773,200

Buildings of All Types—Excluding Public Works and Utilities—Not Designed by Architects..... 2,192,020,000
(Estimated from Averages of Previous Years)

TOTAL ESTIMATED CONSTRUCTION FOR 1929..... $7,308,793,200
(Exclusive of Public Works and Utilities)

© NATIONAL BUILDING PUBLICATIONS, INC., NEW YORK

Detailed Forecast of New Building Construction for 1929

of building activity and perhaps the exceeding of all past records to the amount of 4% or 5% for the year 1929, there are, of course, some significant changes to be taken into consideration.

Expressing the requirements of new buildings in 1929 by percentages the Forum forecast predicts about one-third less building construction in the automotive field than in 1928, slightly more than last year in banks, about the same in apartments, about 10% more in apartment hotels, clubs, etc. 20% less in community and memorial buildings, about the same in churches and hotels, 20% less in hospitals. Industrial building requirements will amount to 40% more according to this estimate, office buildings 15% more, school construction will increase slightly, construction of stores, theatres, welfare, Y. M. C. A. buildings, etc., will, it is believed, increase approximately 20%. In industrial buildings the increase in construction in the North Atlantic states it is estimated will amount to 2.0%, in the Northeastern states it is estimated at 1.8%, in the Southeastern states at 7%, in the Southwestern states at 6.4%, in the Middle states at 1.8% and Western states at 1.2%.

Secretary Whiting Outlines Economic Conditions for 1929

BY WILLIAM F. WHITING, SECRETARY OF COMMERCE

Some of the more important economic forces which dominate the business situation as we enter the New Year are credit conditions, the degree of accumulation of merchandise stocks and of speculation in them, the size of the crops and of our current industrial output, the rate of wages and volume of employment, and the prospects of foreign trade.

With respect to credit conditions 1928 has been an extraordinary from less than ½ per cent higher in southern and western cities to slightly over 1 per cent in New York City while open-market rates for commercial paper have increased by only 1½ per cent during the year.

Agricultural output during the past year was about 5 per cent larger than in 1927 and there was an even greater expansion in manufacturing production, but neither stocks of raw materials nor of manufactured goods have shown any general tendency to accumulate. There is no considerable speculation in commodities and wholesale prices average about the same as a year ago.

Wages continue at a high level and unemployment has been reduced to a minimum. There has been a continued demand for additional workers by mercantile establishments, hotels, and the automotive industry and factories have once more been increasing the number on their payrolls. Labor conflicts in the coal and cotton textile industries were settled during the past year and relations in most sections of the labor world are now amicable.

Activity in the automotive and construction industries has been sustained and is particularly noteworthy. Automobile production has been at a higher level in recent months than at any earlier period and contracts for future construction have been substantially greater than in the corresponding period a year ago. Production of many related products, such as iron and steel, cement, gasoline, and rubber tires has been stimulated as a result of these developments. The textile and coal industries, however, still lag behind the others.

Foreign, as well as domestic, demand for the products of our farms and factories is steadily expanding. During the past year there has been an exceptionally large growth of our exports of finished manufacturers—especially automobiles, machinery, and petroleum products.

The Glass World and What It Is Doing

News of the Industry

Allege Infringement of Laminated Glass Patent

A complaint was filed on December 31, 1928, by the Triplex Safety Glass Company of North America, Clifton, N. J., in the United States District Court for Western Pennsylvania, and served on the Pittsburgh Safety Glass Company, Pittsburgh, Pa., alleging infringement of patent U. S. 1,182,739 issued May 9, 1916, to Edouard Benedictus of Paris, France, covering a process of making laminated glass. The application for this patent was made June 14, 1911. An accounting of profits and damages for infringement is asked for and also an injunction to restrain the Pittsburgh Safety Glass Company from further use of the invention covered by the patent. A reply to the complaint was due January 23 but the time for filing it has been extended to March 4, 1929.

Redding, Greeley, O'Shea & Campbell, counsellors at law, 38 Park Row, New York, with William B. Greeley in charge, are representing the plaintiff. Drury W. Cooper, of New York, is associate counsel. The defendant is represented by Marshall A. Christy of the firm of Christy & Christy, Pittsburgh.

Feldspar Producers Consolidate

The consolidation of a number of important units in the feldspar industry has been consummated, becoming effective February 1, 1929, under the name Consolidated Feldspar Corporation, with headquarters at Trenton, N. J. Herbert P. Margerum, who for several years has been president of Golding Sons Company and the Erwin Feldspar Company of Trenton, N. J., will be president. Norman G. Smith, who has been president of the Maine Feldspar Company, and Robert W. Lawson, who has been vice-president of the Erwin Feldspar Company, will be vice-presidents; M. A. Murray will be secretary and treasurer and V. V. Kelsey of the Erwin Feldspar Company, Inc., will be sales manager. Already included in the new organization are the Maine Feldspar Company, Dominion Feldspar Company, Feldspar Department of the Isco-Bautz Co., Inc. It is understood that the combination will include the above concerns and the Pennsylvania Pulverizing Company's feldspar mill at Rochester, N. Y., and possibly other producers and grinders.

In explanation of the purpose behind the new consolidation one of the company's executives said, "The purpose of the consolidation is clear. It enables us to supply any grade of feldspar any user may specify from Canada to North Carolina, from Maine to South Dakota. It gives a wide range of different spars for all consumers and thus permits us to render a real service."

The combination will result in the completion of a well rounded out feldspar organization controlling ample supplies of raw material and adequate milling facilities in each of the major fields of operation.

American Window Glass to Increase Fourcault Equipment

The success of the American Window Glass Company during the past year in converting its Belle Vernon, Pa. plant from the old cylinder process to the Fourcault process, has led the company to announce that their old plant at Arnold, Pa. will also be changed by the installation of thirteen improved Fourcault process sheet glass drawing machines which will make it the largest single installation of its kind. These machines also, it is stated, will have a larger production capacity than any installation of Fourcault machines heretofore put in operation. The Belle Vernon plant, rebuilt at a cost of approximately $1,000,000, has been operating both day and night shifts with several hundred employes. It is reported that in addition to making the regular single and double strength window glass, the Arnold factory will be specialized to make up to one-half inch drawn glass, and that the production of sheet glass and eventually plate glass for making laminated glass will involve a substantial part of the plant's capacity. Plans are also under consideration for installing two grinding and polishing units for converting part of the glass into polished plate, each of which will be able to turn out 7,500,000 square feet of polished plate per annum. The new Arnold plant will give employment to 500 men when put into full operation. In addition to the Belle Vernon and Arnold plants the American Window Glass Company is considering the installation of the Fourcault Process at a third plant, but which of the Company's plants will be selected has not been announced.

Duty on Belgian Sand Removed.

Reference has been made in previous issues to the recent imposition of duty on Belgian and other foreign glass sand which formerly was permitted to be entered free into the United States. Strong protests against this ruling were made by Pacific Coast glass manufacturers with the result that the order has been rescinded and the duty removed. In announcing this decision the Treasury Department refers to its decision T. D. 42820 now rescinded, to the effect that Belgian sand and other similar sands used in the manufacture of glass were properly subject to duty at the rate of $4.00 per ton under the provision in paragraph 207 of the Tariff Act of 1922 for crude silica and were not free of duty under the provision in paragraph 1675 for sand.

This decision had been predicated upon information which constrained the Department to believe that Belgian sand and other glass sands were commercially known as silica and its conclusion that the merchandise was dutiable as silica was in part derived from information furnished by the Geological Survey, Department of the Interior, and the Bureau of Standards, Department of Commerce.

The strong protests filed by the importers of glass sand led to a further investigation by the Department which consulted with the Geological Survey and the Bureau of Standards and Bureau of Mines. The consensus of opinion expressed by these organizations was that while the term silica is sometimes applied as a class name for miscellaneous groups of mineral substances, these terms are of special usage rather than commercial terms. Glass sand is never bought nor sold as silica in commerce. In view of the reports received from these three organizations and other information obtained, the Department now admits that its action in placing a duty on the foreign sand was based upon an erroneous view of the facts and has rescinded its ruling T. D. 42820, permitting the Belgian and similar glass sand entry into this country free of duty.

Total 1928 Production of Plate Glass

From figures compiled by P. A. Hughes, secretary of the Plate Glass Manufacturers of America, the total production of polished plate glass for the year 1928 was 130,649,435 sq. ft. These figures represent the entire industry in the United States, and can be summarized as follows:

1st quarter	31,465,932 sq. ft.
2nd quarter	32,795,701 sq. ft.
3rd quarter	33,022,654 sq. ft.
4th quarter	33,365,148 sq. ft.
	130,649,435 sq. ft.

Of this total, 10,578,867 sq. ft. was produced in the month of December, 1928.

Construction Total for 1928

The 1928 construction volume was the highest in the history of the country, according to F. W. Dodge Corporation. Contracts let on new building and engineering work in the 37 states east of the Rocky Mountains during the past year reached a total of $6,628,286,100. This figure was 5 per cent ahead of the total for

the year 1927 and it was 4 per cent in excess of the total for 1926. The previous high record had been held by 1926. The territory covered in the 37 Eastern States represents about 91 per cent of the country's total construction. There was $432,756,300 worth of contracts let on new construction work during December. The above figure was 8 per cent below the total for November 1928 and there was a drop of 9 per cent from the December 1927 record.

New York Curb Dealings in Glass Stocks

In *The New York Times* of January 1 a report of the New York curb market dealings in glass stocks covering the year 1928 was given as follows:

	High	*Low*	*Last*	*Net. Changes*	*Year's Sales*
American Window Glass Machine	31⅞	24	31⅞	...	800
Hazel-Atlas Glass....	91	80	91	+35½	300
Libbey-Owens Sheet Glass	186	109	182	+56	59,775
Pittsburgh Plate Glass	300	210	273	+60	12,210
do. new	69¾	64½	64½	...	2,100

Auto Output Last Year Broke All Records

Factory sales of automobiles in the United States during the year 1928 amounted to 4,357,384 cars. Canadian production for the same period was 242,382 cars. Both of these achievements are record-breakers, the largest number of cars ever before produced in the United States having been 4,301,134 in 1926 and 204,727 during the same year in Canada. In 1928 the output of passenger cars was 3,826,613 or 29.9% more than in 1927, while that of trucks was 530,771 or 16.7% larger than for the previous year. An overwhelming percentage of the passenger cars are of the closed type, constituting an immense market for the sale of flat, plate and laminated glass windshields and windows.

Refractory Manufacturers Combine

Six manufacturers of fire brick and other refractories operating fifteen plants with an annual capacity of 155,000,000 bricks have been organized into the North American Refractories Company with James D. Ramsay as president, E. M. Weinsfurtner, first vice president, J. M. McKinley, Harry S. Sleicher, John H. Cavender and E. H. Gartrell, vice presidents, H. E. Spuhler, vice president and treasurer.

The companies combining are the Ashland Fire Brick Co., Crescent Refractories Co., Dover Fire Brick Co., Elk Fire Brick Co., Farber Fire Brick Co., and the Queens Run Refractories Co.

Use of Word "Cullet" Not Restricted

In an appeal by Max Levy & Company of Chicago from a decision of the Circuit Court of Cook County, Ill., in a case in which the complainant claimed the exclusive right to the use of the word "cullet" for advertising and other purposes and which was decided against him, the Appellate Court of Illinois recently upheld the Circuit Court decision denying the complainant's claims.

An Omission

In the January issue an inadvertent omission occurred on page 13 in connection with the article entitled "Unexpected Influences May Determine the Lives and Careers of Individuals" by William S. Walbridge, vice president of The Toledo Glass Company. Credit for this article should have been given to *The Engineer* published by Lockwood Greene Engineers, Inc., New York. Mr. Walbridge's article appeared in the December issue of that publication together with an article by H. E. Allen of Toledo, vice president of The Libbey-Owens Sheet Glass Company, on "The Development of Glass Making and the Libbey Owens Process."

Trade Activities

The Diamond Glass Company, Royersford, Pa., it is reported, will place a new furnace in operation very shortly.

The General Glass Sash and Door Company, Cleveland, O., suffered on January 18 a loss by fire of $50,000.

The Pennsylvania Glass Bottle Company at Sheffield, Pa., closed down January 16 on account of a break in the melting tank.

The Belmont Tumbler Company, Bellaire, O., are installing a new tank. Their old tank is being repaired and put in good condition for early operation.

The Brown Instrument Company have announced that their New York office, formerly located at 50 Church Street has been moved to 117 Liberty Street.

The Adamston Flat Glass Company, Clarksburg, W. Va., has prepared plans for the replacement of two of their Fourcault drawing tanks at a cost reported to approximate $50,000.

The Brookville Mirror Works, Brookville, Pa., is reported to be putting up a three story building to occupy a space of 24 by 40 feet. Grant Sheaknocker is said to be financing the venture.

Edgar A. McCulloch has become chairman of the Federal Trade Commission, succeeding Abram F. Myers who recently resigned. Judge McCulloch was formerly chief justice of the Arkansas Supreme Court.

J. Cecil Fee, general manager of the Central Glass Works, Wheeling, W. Va., and connected with the company for many years, resigned on January 1 and will devote his time hereafter to other activities.

The Akro Agate Company, Clarksburg, W. Va., recently shut down their marble manufacturing plant for an indefinite period. Such a large stock of marbles has been accumulated, it is said, that it was deemed advisable to take this action.

The Canton Glass Company, Marion, Ind., recently elected B. N. Nussbaum of New York to be president in succession to his father, the late Leo Nussbaum who died December 20. E. J. Mason will continue as treasurer and F. L. Paul as secretary.

The Weston Glass Company, Inc., Weston, W. Va., at their recent annual meeting elected the following officers: Louie Wohinc, president; John Weber, vice-president; Ray Lorentz, treasurer; G. Hager, attorney; E. Hager, general manager, and Max Adolt, secretary.

Glendale Glass Tile Company, Glendale, Cal., has been incorporated with a capital of $250,000 and it is reported has started work on a factory at 1732 Standard Avenue. J. M. Ernst, at one time connected with the Standard Glass Company, is president of the new corporation.

The Illinois-Pacific Glass Company, Los Angeles, according to news from that city will shortly put their new bottle plant into operation. This plant like the company's fine factory at San Francisco is equipped with electrically heated annealing furnaces. The production capacity of the new plant will be about 300,000 gross of bottles and jars yearly.

The Annual Glass and Pottery Show with displays of domestic and imported specimens held in the Fort Pitt and William Penn and other hotels in Pittsburgh, closing January 19, drew a large attendance. John H. Harris was re-elected president and Frank H. Lange secretary and treasurer. The annual dinner dance was attended by several hundred visitors.

The Simplex Engineering Company, Washington, Pa., according to C. E. Frazier, president, who recently returned from a trip that included South America and Europe, was successful in obtaining contracts for a substantial amount of glass factory construction and equipment in Argentina, Brazil, Germany and England.

The Corl-Erie Glass Company, is said to have purchased the property and equipment from representatives of the bondholders of the factory formerly operated by the defunct Licking Glass Company at Utica, O. This plant has been idle for a number of years and about two years ago came into the possession of Miss Cora B. Clark, president of the First National Bank at Utica. It is said that the plant originally cost more than $500,000.

Ball Brothers Glass Company, Muncie, Ind., it is announced have acquired the Pine Glass Corporation of Okmulgee, Okla., of which U. S. Senator W. B. Pine is president. The reported purchase price is $450,000. The Okmulgee plant has been operating recently on the production of jelly glasses, fruit jars and packers wares. It is reported that after repairs to the large tank are completed work will be resumed under Ball Brothers ownership with a largely increased force of workers.

The Sharp-Schurtz Company, glass chemists and consulting engineers, Lancaster, O., announce the addition of a new member to their working staff, Miss Mary Keyes who was

formerly connected with the U. S. Geological Survey, and for the past five years was Assistant to Dr. Henry S. Washington of the Geophysical Laboratories, a Carnegie Institution of research at Washington, D. C. The addition of Miss Keyes to the staff will enable the company to render greater service to the glass industry through more extensive research.

New Colored Glass at Pittsburgh Show

According to Theodore Lenchner of the Roessler & Hasslacher Chemical Company, the most talked of subject at the recent glass show in Pittsburgh was a new colored glass shown by Kay & Ellinger, importers, 30 Irving Place, New York. It was found that this glass is made in Czechoslovakia by a firm of the name Moeser. It is called Alexandrite and according to the importers the glass is colored by the use of a rare mineral, alexandrite, which is beryllium. The color may be described as a pure amethyst much cleaner and much more attractive than a color produced through the use of manganese.

Recent Deaths

Henry C. Fry

Henry C. Fry, president of the H. C. Fry Glass Company and one of the best known glass men of the country died at his home in Rochester, Pa., early in January at the age of eighty-nine. In 1857 Mr. Fry entered the glass business in a minor capacity in one of the old Pittsburgh glass plants. He enlisted and served over two years in the Civil War in the 15th Regiment of the Pennsylvania Cavalry and participated in the battles of the Army of the Cumberland. After the war he became a partner in the firm of Lippincott, Fry & Company of Pittsburgh. In 1869 he retired from that firm and in 1872 established his residence in Rochester, Pa., and organized the Rochester Tumbler Company. Early in this century he established the H. C. Fry Glass Company which specialized in high grade cut glass. He was interested in other industries and he became president of the First National Bank in Rochester, Pa., which office he occupied for many years. He was formerly a member of the school board and of the council of that city. Mrs. Fry and two sons, Major A. C. Fry, and J. Howard Fry of Chicago and three daughters survive him.

John Koblegard, Sr.

John Koblegard, Sr., for some time president and general manager of the old West Fork Glass Company, Clarksburg, W. Va., died on January 10th of pneumonia. He was 82 years of age.

Alfred Henry Otis

The death has been announced of Alfred Henry Otis, vice president and general sales manager of the Kimble Glass Company, Vineland, N. J. on Wednesday, January 2, 1929.

E. C. Danner

Emil Carl Danner, mechanical and electrical engineer of the United States Glass Company, Pittsburgh, Pa., died on Jan. 9, at the age of forty-three.

Eugene Miner Taylor

Eugene Miner Taylor, for thirty years in charge of sales for the Michigan Alkali Company and well known throughout the industry died at Miami Beach, Fla., on Friday, December 28, 1928.

Coming Meetings

American Ceramic Society Annual and Division meetings and Ceramic Exposition, Hotel Stevens, Chicago, Ill., February 4 to 9, 1929. This period is to be known as Ceramic Week.

The Glass Container Association will hold its annual meeting at Atlantic City, May 1 to 3. The mid-winter meeting usually held in February will not take place this year.

The Artistic Lighting Equipment Association will hold its annual meeting at the Cavalier Hotel, Virginia Beach, Norfolk, Va., February 5 to 8, 1929, inclusive. A boat party is being organized to make the trip from New York to Norfolk on the Old Virginia Line, then via bus to Virginia Beach. The boat will sail from New York at 1 P. M. Tuesday, February 5. James Krieger, 215 Fourth Avenue, New York is in charge of arrangements. Reservations at the Cavalier Hotel may be obtained from G. P. Rogers, 420 Lexington Avenue, New York.

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

Mexico—35827, Glass bottles and jars with stamped metal covers, for preserving and pickling.

Canada—35817, Glassware and crockery.

Colombia—35716, Cut glass and vases.

Argentina—35660, Glassware.

Argentina—35360, Glassware.

India—35390, Glassware and ceramics.

Inquiries Received

For further information address THE GLASS INDUSTRY

450. Please put us in touch with concerns that manufacture glass salt shakers with metal caps.

451. Where can we purchase various types of common bottles, tumblers, mugs, etc. direct from the manufacturer?

452. We would like to get in touch with manufacturers of molded and pressed glass.

453. Please give us the names of manufacturers of lead glass tableware, etc.

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE, JANUARY 22, 1929.
Reported by Moore, Leonard & Lynch, Union Bank Bldg., Pittsburgh, Pa.

	Bid	Asked	Last
American Window Glass Com	..	..	..
American Window Glass Pfd.	..	88	90
American Window Glass Mch.			
Common	..	..	32
Pfd. Cumulative	48	..	48
Pittsburgh Plate Glass (New)	..	..	75
Standard Plate Glass:			
Common	6½	..	5⅛
Pfd. Cumulative	25½	..	23¼
Prior Pfd.	..	..	30¼
United States Glass	..	..	11

TOLEDO, O., JANUARY 22, 1929

	Bid	Asked	Last
Owens Bottle, Pfd.	..	..	..
Libbey-Owens Sheet Glass, Com.	..	..	..
Libbey-Owens Sheet Glass, Pfd.	115	..	116½

WHEELING STOCK EXCHANGE, JANUARY 22, 1929

	Bid	Asked	Last
Hazel-Atlas	109½	110	110
Imperial	..	38	72
Fostoria	190	..	185
Central	..	..	75
Jefferson, Pfd.	..	..	96

READERS' WANTS AND OFFERS

SALESMAN WANTED

Salesman Wanted: A side line salesman familiar with trades using acids, for selling a safety device of extraordinary merit. Address O-3 care THE GLASS INDUSTRY, 50 Church Street, New York.

FACTORY MANAGER

Position wanted, by Factory Manager capable of handling continuous, day, and recuperator tanks fired with natural gas, producer gas, or oil. Can make glass, operate Miller, Lynch, and O'Neill machines under Hartford-Empire, Miller, or private feeders, making bottles, packers' ware, pressed ware, and thin blown tumblers. Can handle men and give reference. Address SW-5, care THE GLASS INDUSTRY, 50 Church St., New York.

Current Prices of Glass-Making Materials

January 21, 1929

Quotations furnished by various producers, manufacturers and dealers.

Acid		Carlots	Less Carlots
Citric (dom.)	lb.	.46	.46
Hydrochloric (HCl) 20° tanks, per 100 lb.		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	.38	.38½
Alcohol, denatured	gal.	..	.52
Aluminum hydrate (Al $(OH)_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.21-.22
Ammonia water (NH_4OH) 26° drums	lb.	.03	.03¼
Antimony, metallic (Sb)	lb.	..	.09⅝
Antimony oxide (Sb_2O_3)	lb.	..	.12-.14
Antimony sulphide (Sb_2S_3)	lb.	..	.14
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.05
Barium carbonate ($BaCO_3$)			
Precipitated	ton	57.50	60.00
Natural, powdered, imported	ton	45.00	50.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	.04¾-.05½
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08¼	.08½
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	28.00-35.00	..
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton	..	16.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7.10H_2O$)	lb.	.02½-.02¾	.02⅞-.03¾
Boric acid (H_3BO_3)	lb.	.05½-.05¾	.06-.07
Refined	lb.	.05½-.05¾	.06-.07
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	1.00-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.24	.25
Cobalt oxide (Co_3O_4)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	..	.30
Cryolite ($Na_3Al\ F_6$) Natural Greenland Kryolith)	lb.	.09	.10-.10½
Artificial or Chemical	lb.	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.20
Feldspar—			
100 mesh	ton	13.00-20.00	15.50-22.00
80 mesh	ton	11.00-11.75	14.50
40 mesh	ton	11.00	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	..	.09½
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.03¼-.03½
Black (FeO)	lb.	.03½	..
Kaolin (f.o.b. mine)	ton	9.00	..
English, lump, f.o.b. New York	ton	14.50-25.00	24.50-30.00
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	.0915	.09¾-.10
Litharge (PbO)	lb.	.0815-.08¾	.08¾-.09
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	11.50-12.50	..
Burnt (CaO) ground, in bulk	ton	8.00	..
Burnt, ground, in paper sacks	ton	10.00-11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15-2.25	2.30-2.60
Limestone ($CaCO_3$)		2.00	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.08
Manganese 85% (MnO_2)	lb.	.04	.04½
Nickel oxide (Ni_2O_3), black—			
for nickel content	lb.	..	.35
Nickel monoxide (NiO), green—			
for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.09	.09¾
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06½	.07
Hydrated 80-85%	lb.	.05¾	.06¼
Potassium chromate (K_2CrO_4)	lb.	..	.23-.32
Potassium hydrate (KOH) (caustic potash)	lb.	.07⅛	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.05⅞-.06
Potassium permanganate ($KMnO_4$)	lb.	.16	.16½
Powdered blue	lb.	..	24-.26
Rochelle salts, bbls.	lb.	..	.23
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	1.90-2.00
Silver nitrate ($AgNO_3$)	(100 oz.) per oz.	..	.39
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½	..
In barrels	Per 100 lb.	1.55-1.57½	2.40
In bags	Per 100 lb.	1.37½-1.40	..
Spot orders	.025 per 100 lbs. higher		
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07½
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb.	2.90	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03⅞	.04½
95 per cent.	Per 100 lb.	2.17½-2.20	2.50
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.50
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.39	.37½
Tin oxide (SnO_2) in bbls.	lb.	..	.56
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb.	..	1.50-2.25
Zinc oxide (ZnO)	lb.	.08½	.12
American process, Bags	lb.	.06½	.07
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

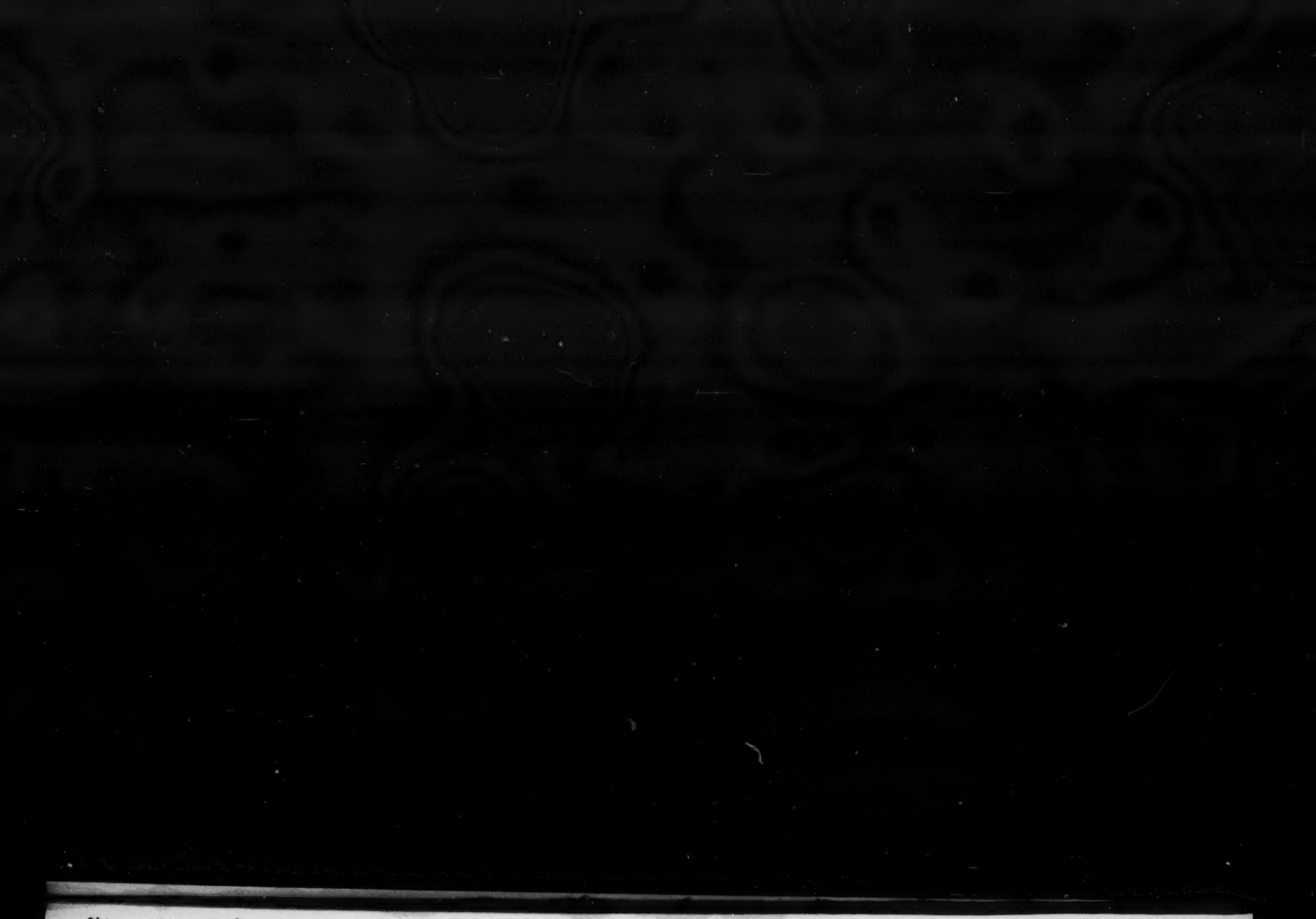
Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to December 27, 1928

	November 1927 Quantity	November 1927 Value	November 1928 Quantity	November 1928 Value	Eleven Months Ending November 1927 Quantity	Eleven Months Ending November 1927 Value	Eleven Months Ending November 1928 Quantity	Eleven Months Ending November 1928 Value
Glass and glass products (total)	.....	$743,816	.....	$904,318	.....	$8,141,528	.....	$9,227,513
Plate and window glass—								
Window glass, common, box 50 sq .ft.	1,268	8,727	1,803	7,929	20,483	112,682	15,026	88,906
Plate glass, unsilvered, sq. ft.	108,263	27,762	106,279	35,634	982,643	307,432	2,065,343	619,645
Other window and plate glass lbs.	298,617	31,071	749,522	67,521	3,820,262	396,749	3,526,842	395,501
Glass containers (bottles, vials and jars)	.....	204,165	.....	268,564	.....	2,823,209	.....	3,253,216
Table glassware, plain	.....	121,461	.....	141,473	.....	1,319,876	.....	1,260,816
Table and other glassware, cut or engraved	.....	12,445	.....	8,408	.....	129,265	.....	128,069
Lamp chimneys and lantern globes lbs.	221,818	45,327	74,146	16,699	1,762,546	359,896	1,476,996	301,397
Globes and shades for lighting fixtures lbs.	159,667	60,855	163,108	61,109	1,527,906	560,936	1,638,354	584,305
Chemical glassware lbs.	17,506	18,912	28,687	20,635	105,521	177,351	213,078	180,256
Electrical glassware, except for lighting lbs.	212,766	26,291	291,315	39,743	2,118,757	222,122	4,346,884	378,155
Other glassware	.....	186,800	.....	236,603	.....	1,732,010	.....	2,037,247

IMPORTS

Corrected to December 27, 1928

		November 1927 Quantity	November 1927 Value	November 1928 Quantity	November 1928 Value	Eleven Months Ending November 1927 Quantity	Eleven Months Ending November 1927 Value	Eleven Months Ending November 1928 Quantity	Eleven Months Ending November 1928 Value
Glass and glass products		.....	$1,505,233	.....	$1,247,637	.....	$15,663,096	.....	$14,181,748
Cylinder, crown and sheet—									
Unpolished, not bent, obscured, beveled, etc.—									
Weighing less than 80 pounds per case	dut. lb.	2,036,989	52,301	2,366,005	86,909	42,260,211	1,109,538	33,589,519	1,050,396
Weighing 80 pounds or over per case	dut. lb.	1,746,994	103,608	1,433,016	56,682	34,774,525	1,513,872	27,962,443	1,240,153
Polished and bent, obscured, beveled, colored, etc., unpolished and polished, and all silvered	dut.	.....	31,060	.....	53,906	.....	353,883	.....	518,954
Plate glass—									
Polished, unsilvered	dut. sq. ft.	1,101,091	269,193	1,610,709	311,661	14,371,505	4,038,155	14,736,015	3,145,293
Other	dut. sq. ft.	206,943	41,569	168,911	33,877	1,248,454	291,898	1,601,989	426,564
Bottles, vials, jars, demijohns and carboys, molded or pressed	dut.	.....	15,998	.....	18,598	.....	175,166	.....	225,875
Table and kitchen utensils	dut.	.....	30,955	.....	29,395	.....	173,694	.....	264,029
Glassware, cut or decorated	dut.	.....	357,520	.....	302,629	.....	3,460,444	.....	2,660,103
Blown glassware, n. e. s.—									
Bottles, ornaments, gauge glasses and other n. e. s.	dut.	.....	274,523	.....	88,496	.....	1,695,011	.....	1,809,207
Bulbs for electric lamps	dut. No.	1,561,681	22,156	1,484,193	14,219	13,656,326	143,563	13,956,489	154,806
Chimneys, globes, shades, prisms and other illuminating glassware	dut.	.....	126,087	.....	93,531	.....	891,864	.....	890,534
Articles and utensils for chemical, scientific, and experimental purposes	dut.	.....	38,530	.....	37,852	.....	478,659	.....	499,008
Other glassware	dut.	.....	141,733	.....	119,882	.....	1,337,349	.....	1,296,826